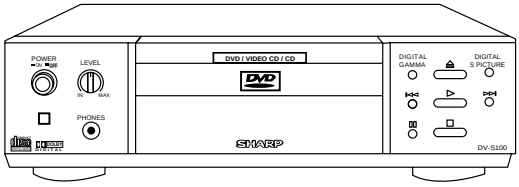
SHARP TECHNICAL MANUAL

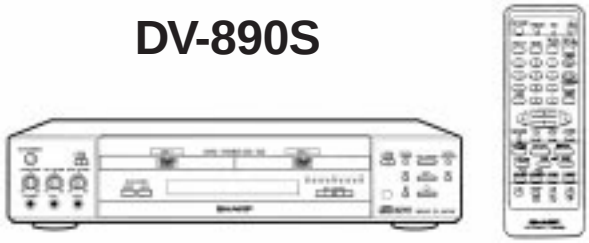
T58P2DV-500D/

DVD VIDEO PLAYER

MODELS

DV-500D
DV-550
DV-550W/X
DV-550U
DV-560S
DV-560H
DV-800D
DV-880
DV-880X/W
DV-890S





CONTENTS

page

1. The Birth of DVD 3
2. DVD Features 6
3. Technical Point of DVDs 13
4. DVD Servo Circulation 20
5. TRAYMECHA Control 27
6. TRAYMECHA Timing Chart 32

1. The Birth of DVD

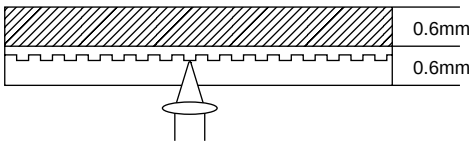
1-1 Main Specifications of the DVD Video Player

Disc Diameter	120mm
Disc Thickness	1.2mm 0.6mm x 2
Semiconductor Laser Wavelength	650nm
Lens (NA)	0.6
Pit Length	0.4~1.87μm / 0.44~2.05μm (Single Layer) (Double Layer)
Track Pitch	0.74μm
Sector Allocation	CLV
Modulation System	8/16 Modulation
Correction System	RS-PC (Reed Solomon Product Code)
Memory Capacity	① 4.7GB (1 Layer on 1 Side)
	② 8.5GB (2 Layers on 1 Side)
	③ 9.4GB (1 Layer on Both Sides)
	④ 17GB (2 Layers on Both Sides)

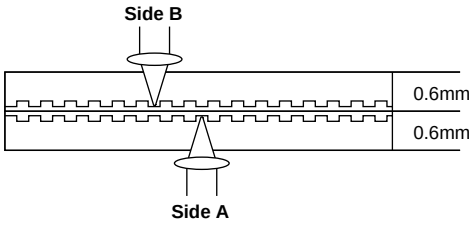
1-2 Type of Discs

There are 4 types of discs.

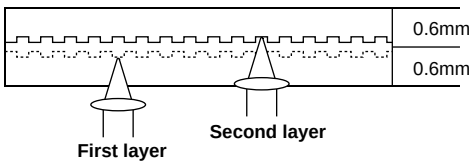
(1) 1 layer on 1 side disc



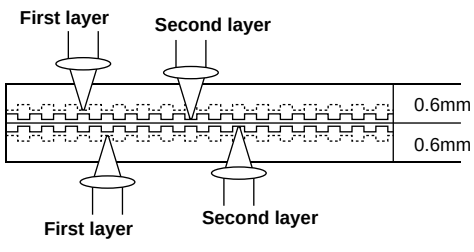
(2) 1 layer both sides disc



(3) 2 layers on 1 side disc



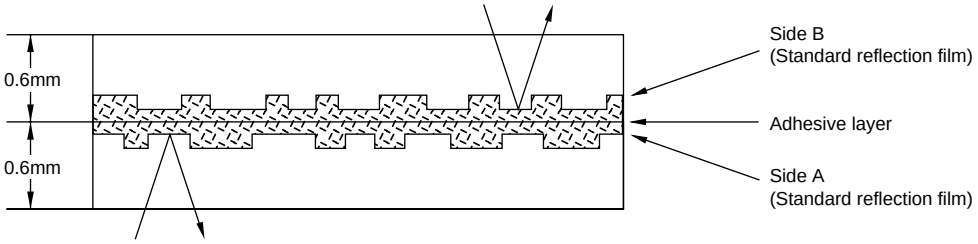
(4) 2 layers on both sides disc



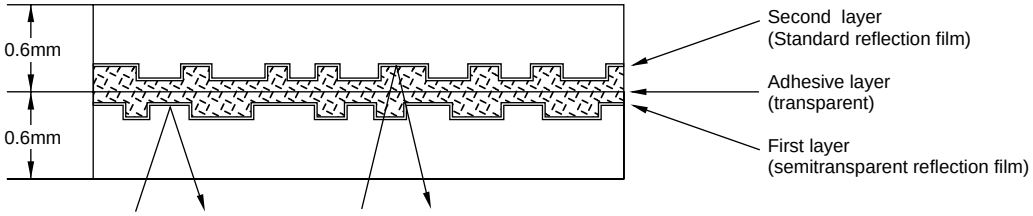
1-3 Disc Structure

The first layer on the 2-layers disc (semitransparent reflection film) does not reflect unless the laser light is focused.

(1) 1 layer on both sides



(2) 2 layers on 1 sides



1-4 Disc Capacity

Type of Disc / Disc Size	1 layer on 1 side	2 layers on 1 side	1 layer on both sides	2 layers on both sides
12cm	4.7	8.5	9.4	17
8cm	1.4	2.6	2.9	5.3

1-5 Example of the DVD's calculating memory capacity Condition

Condition

1. More than 3.5Mbps of average image data rate
   (The compression rate changes depending on the image. This is the average value)
2. Audio is Dolby AC-3, 5.1ch digital sound
3. Dubbed in 3 languages + subtitled in 4 languages
4. 133 minutes are recorded on a 1 layer on 1 side disc

Required data rate

Image		Audio		Subtitles		Total
3,500k	+	(384k × 3)	+	(10k)	=	4,692kbps(bit/second)

Required disc capacity

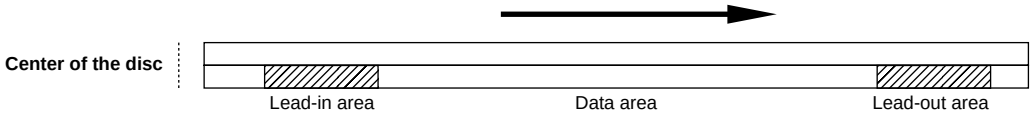
Data Rate		Recording Duration		Memory Capacity
4, 692kbps	×	(133 × 60) second ÷ 8 (8bit = 1byte)	=	4.680.270kBytes

4.7 gigabytes are required to record 133 minutes on a 1 layer on 1 side disc

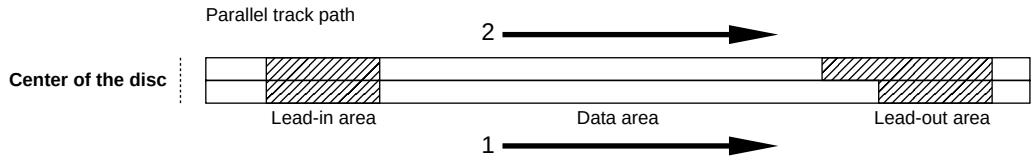
1-6 Order and Direction of Disc Recording

There are 3 types of recording orders and directions.

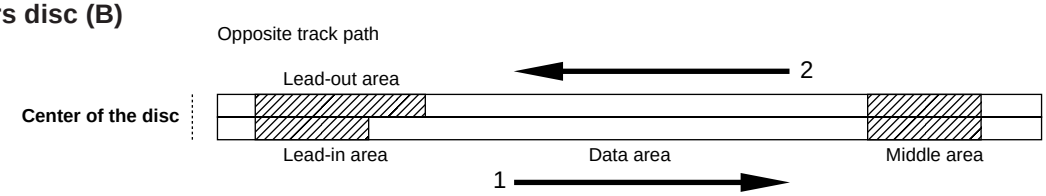
1 layer disc



2 layers disc (A)



2 layers disc (B)

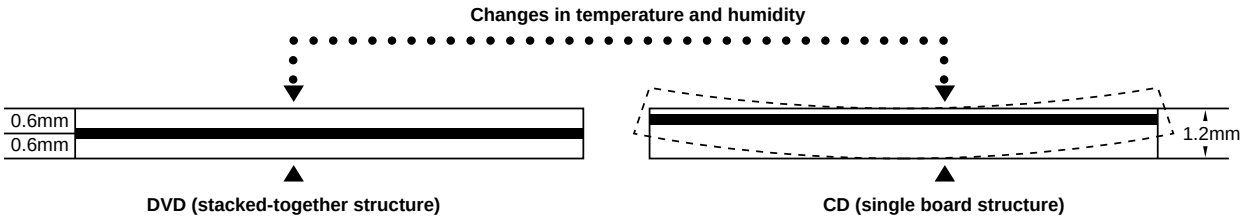


1-7 Two Discs are Stacked Together to Form DVD discs

The DVD disc structure is the stacking of two 0.6mm thin type discs, making it most suitable for reading high density recorded data signals.

The thinner the disc, the less number of obstacles between pits notched on the optical pick up and disc, so more precise reading can be achieved.

Additionally, stacking these same material discs together back-to-back, increases evenness, meaning the disc will warp less due to heat and humidity compared to single 1.2mm boards. Thus, the discs are more reliable.



Features of the 0.6mm Thick Disc

1. **Materialized mass capacity and high density**
   - Because the thickness is half that of traditional discs, it is less likely to warp or slant.
   - Degree of evenness becomes much higher at assembly, with high rates of evenness and precision.
2. **Makes board-making easier and reduces production costs**
   - The stacked structure is highly resistant to environmental changes (heat, humidity)
   - The thin structure increases the time cycle, so forming is easier stabilized
   - Overall, it will cost less than 20% more than a CD.

2. DVD Features

2-1 DVD is not a Digital Video Disc

"DVD" is often considereed the abbreviation for Digital Video Disc, but as the unified standard for the next generation of high density optical fiber discs, the term "DVD" is not used in that way. It has been adopted as the name of the unified standard.

2-2 Amazing Mega-Capacity

Although the DVD's size is the same as a 12cm CD, one DVD side can record huge capacity, about 4.7GB, equivalent to approximately 7 CDs. This disc can be recorded to 133 minutes for full a movie film, with high quality picture and sound which like a movie theater.
Additionally, it is only the capacity for one side. The 1 side 2 layer type can record 8.5GB, the 2 sides with 1 layer type can record 9.4 GB and an amazing maximum 17GB can be recorded on 2 side 2 layers type.

● **Comparison of DVD data capacity**

● **Comparison of DVD recording times (approximate)**

The memory capacity of a disc is determined by the time of information and amount of data per second (data rate). In the case of CDs, the number of quantization bits is 16, and the sampling wavelength is 44.1kHz with 2 channels. So, the amount of data is $16 \times 44.1k \times 2$ = approx.1,411k bits/second = 1.411M bits/second.
The maximum length of a CD is 74 minutes. If the same sound from a CD is recorded on the DVD, it comes to 4.7GB. That means, 37.6 (4.7×8), and it will come to $37.6 \times 1{,}000 \div 1.411$ = approx. 26,648 (seconds) for one side.
That is approximately 444 minutes (7 hours 24 minutes).

2-3 Secrets of Producing Large Capacity Recording and Long Hour Replay

1. Realization of large capacity recording

The track pitch is less than half of that of a CD, making it longer.
Also, the recorded amount of information is increased due to the smaller pit (less than half of that of a CD)
Because the pit is smaller, the laser focus needs to be smaller. To do this, the wavelength of the laser beam is shortened and the opening of the object lens (NA) is increased.
This bigger NA increases the influence of the aberration of laser beam from the protection film (the transparent plastic part). This causes blurring of the laser focus against the disc inclination, or its slippage when the pit becomes bigger, lowering the signal reading precision (increasing noise).
To decrease the influence of this laser beam aberration from protection film (transparent plastic part), we decreased the thickness of the disc.
(one-half that of a CD, 0.6mm) Also ensure CD compatibility, we put 2 of the discs together.
By putting 2 of these 0.6mm thick discs together, the evenness of the disc is increased, warping due to heat and humidity is decreased and the signal reading precision is improved.2.

2. Comparison of CDs and DVDs

Item	CD	DVD	DVD(CD)
Track Pitch	1.60μm	0.74μm	1.60μm
Minimum Pit	0.87μm	0.40μm	0.87μm
Laser Beam Wavelength	780nm (Infrared Light)	650nm(Red)	650nm(Red)
Opening of the Object Lens	0.45	0.6	0.38
Laser Focus	1.8μm	1.0μm	1.7μm

***CD mode of DVD**

3. Decreasing the Laser Beam Focus Wavelength

The size of the laser beam focus Φ has small λ, When NA increases, it becomes smaller. It is determined using the following formul:

NA (Opening of the object lens) = DVD : 0.6

CD(DVD) : 0.38

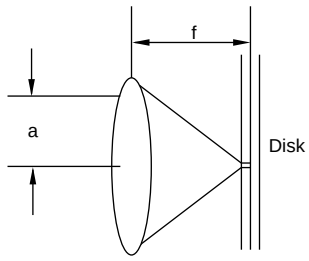
$$\Phi = \frac{\lambda}{NA}$$

λ (laser beam wavelength) = 650nm

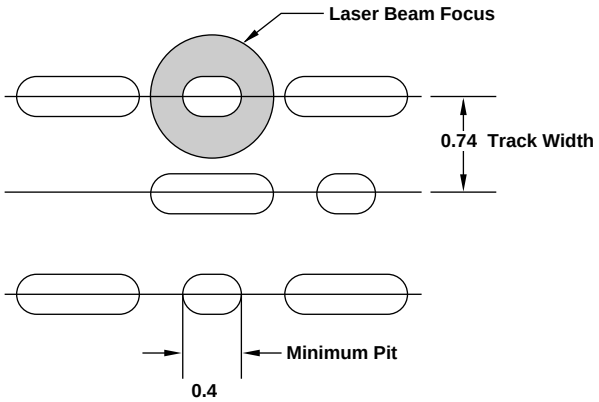
DVD $\Phi = \frac{650nm}{0.6}$ = about 1μm CD(DVD) $\Phi = \frac{650nm}{0.38}$ = about 1.7μm

NA shows the brightness of the lens. When the focal distance of the lens becomes shorter and the diameter increases, the NA becomes bigger. It is determined using the following formul:

$$NA = \frac{a}{f}$$

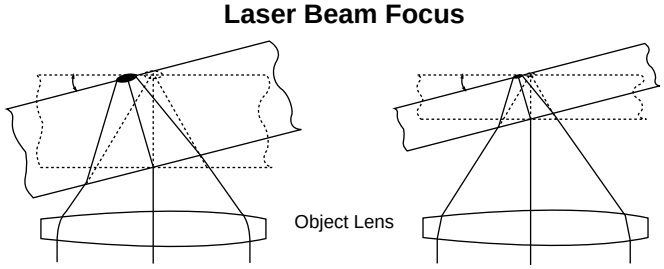


4. Longer Track, Smaller Pit



5. Thinner Disc

Decreasing the thickness of a disc can cause less focus movement against similar disc inclination and less focus disorder.



6. Realization of Long Hour Reproduction

Even by making the track longer and the pit smaller to expand capacity, it is not possible to record one whole movie on one side (1 layer) of a 12cm DVD disc if using current image data information. To reproduce 133 minutes on a 1 layer on 1 side disc, it is necessary to digitally compress the image data.

Most digital compression technology of data is done is the audio field.

It is already routinely used in personal computers and MD.

To make comparisons with the audio field, digital compression technology for images, which contain far more information, were processed by the MPEG (Moving Picture Image Coding Expert Group) committee of ISO, and became the world standard.

First, MPEG1 (a fixed bit rate system) was standardized and made practical for use in video CDs (karaoke, etc.).

Then, MPEG2, DVD actualization, became standardized. MPEG2 is called “Variable Bit Rate System”.

It compresses information while changing the amount of data, depending on the amount of data on the image. That means, it compares the former and latter images, then records the amount of change as data.

2-4 Realization of High Quality Images

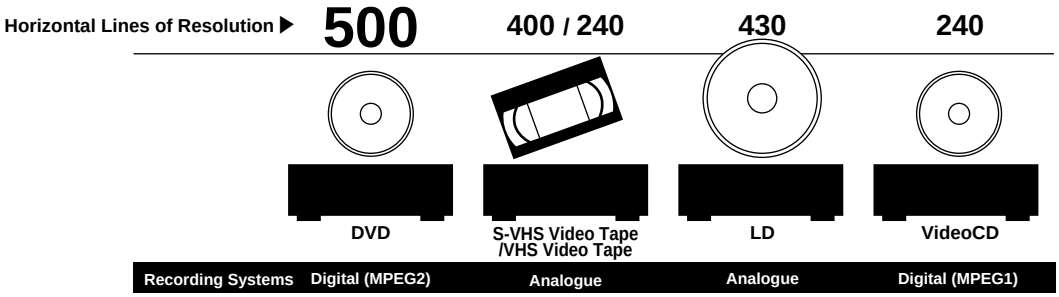
1. High Quality Imaging and Resolving Rate through Full Digitalization

The image performance of DVD actualizes 500 horizontal lines of resolution, an increase from traditional recording media.

Currently, it is superior to the “the media with the highest quality image”, an LD (430 horizontal lines of resolution). It matches master tapes made to professional specifications.

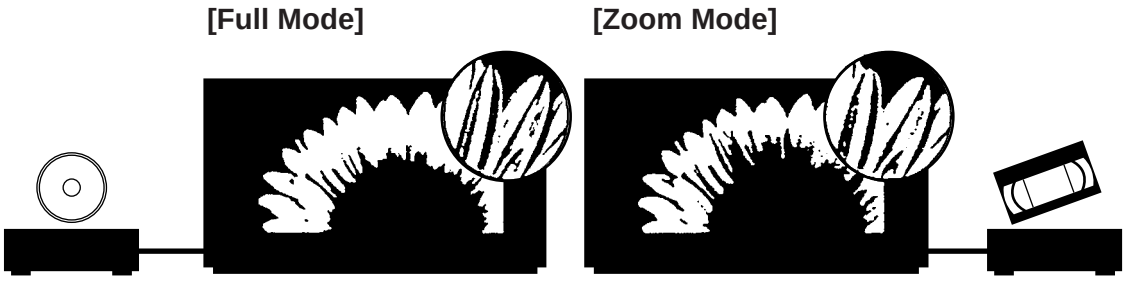
With its high quality imaging and high number of resolution lines, image outlines are sharp. Even in dark scenes, there is less noise and clearer perspective.

- **Compared with to horizontal lines of resolition / recording system of DVD and traditional media**



● **DVD responds to wide sized screens**

From the beginning of its development, DVD was meant to be applicable for wide sizes. When zoom reproduced (expanding the mage in vertical and horizontal directions) on a wide screen monitor, the picture quality isn't weakened. Instead, a beautiful and delicate image is reproduced.



▲ This DVD reproduced by wide TV. It realize of high quality images.

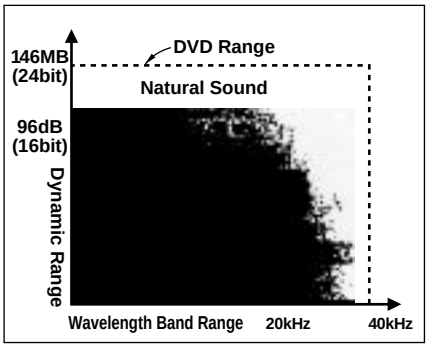
▲ This video reproduced by wide TV. But, it worries about weakness of picture of quality.

*This picture is image illustration for identification effects.

2-5 Super Digital Sound That Surpasses CDs

1. 144dB Dynamic Range can be recorded

To use its large capacity equivalent to 7 times the time available on a CD in an effective way, the 96kHz/24bit high sampling/high bit can record a dynamic range of 144dB super hi-fi digital audio. It also reproduces sounds beyond the range of human hearing, restoring subtle nuance to original sounds.



An example of a dynamic range comparison on DVD and CD

2. Sound Equivalent to Movie Theaters

DVD adopts Dolby AC-3, 5.1ch.

In addition to the 4 channels on front, back, right and left, a center channel used mainly for dialogue and a heavy lower sound are included, to make 5.1 channels.

With these, fully digital sound can be recorded and reproduced with this unit.2-6

2-6 Various Advanced Functions of DVD

These functions are able to be included on DVD discs, and the content is decided on the disc side. Therefore, there are various contents available, depending on the DVD disc used. Only included functions can be reproduced by remote control operation.

1. Multi-Language Response

(1) Sound Selection

DVD Video contains a maximum of 8 sound streams. They flow together like traffic a digital signal road. Do not confuse this with “8 channels”.

Including the original language, a maximum of 8 different languages can be recorded.

Additionally, Dolby AC-3, 5.1ch can be included on all 8 streams.

For example, it is possible to put English sound 5.1ch on the first, French sound 5.1ch on the second and non-compressed linear PCM on the third stream.

However, it requires an amount of data, so the recording time of images will be shortened.

To make the image recording time longer, there are options, such as occupying less streams, and using 2 Dolby AC-3 channels instead of non-compressed linear PCM.

(2) Subtitle Selection

Using the maximum 32 channel sub-image, DVD can process subtitles in a maximum of 32 languages.

Each language can be individually recorded on each channel, such as Japanese, English, French, etc.

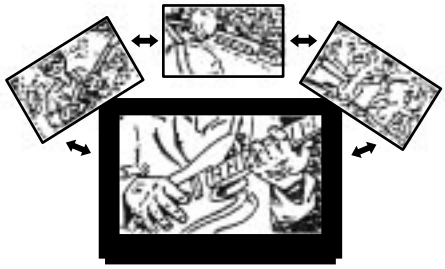
2. Special Mode

(1) Multi-Angle Function

A maximum of 9 image angles from a concert, sporting event, drama, etc. can be recorded with a multiple numbers of cameras. When the event is recorded in such way on a DVD disc, you can choose the angle that you want to see.

(2) Parental Lock

With the multi-story application, functions that can prevent younger viewers from seeing sex or violent scenes that parents don’t want their children to watch include the following:



① Cutting the scene

② Replace the scene with a prepared safe scene

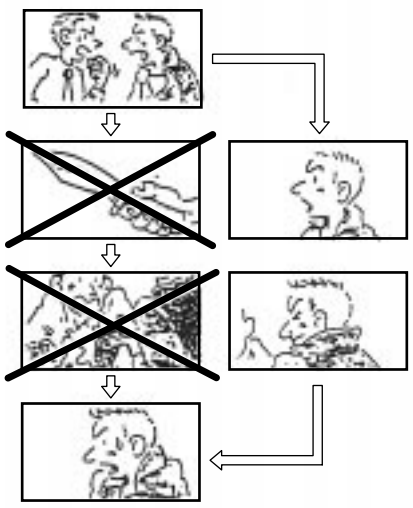
③ Disc unable to be reproduced

* Locking function are set with the locking level

* There are a maximum of 9 locking levels. These levels determined and set following the laws of the country where the product is being sold.

* DVD disc will set a certain lock level beforehand when scenes that parents do not want their children to watch are recorded.

* When a lock level is set on an a DVD video player, scenes or discs that violate that level cannot be reproduced



(3) Multi-Story Function

If there are a number of subplots or side stories to a show, you can change its flow by choosing story developments beforehand, or by pulling the menu at each divergence in the story to choose your favorite stories.

A. Main story and side story function

By selecting stories, it is possible to reproduce not only the main story but a sub story that develops as a supporting role, just by choosing one.

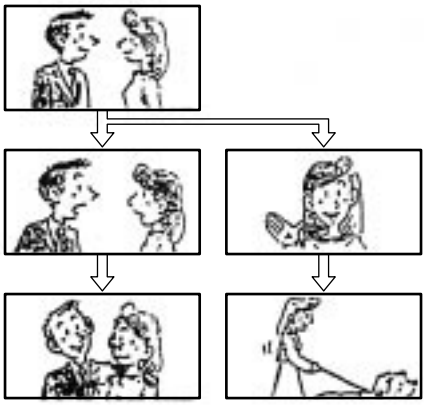
B. Multi-Version Function

It is possible to edit and reproduce a mixture of different versions, such as a theater version, a complete version and a director's cut version, without causing any breaks in the story.

C. Highlighted Scene Scanning Function

Scenes of your favorite actors/actresses, musicals and so on can be reproduced without causing any breaks in the story.

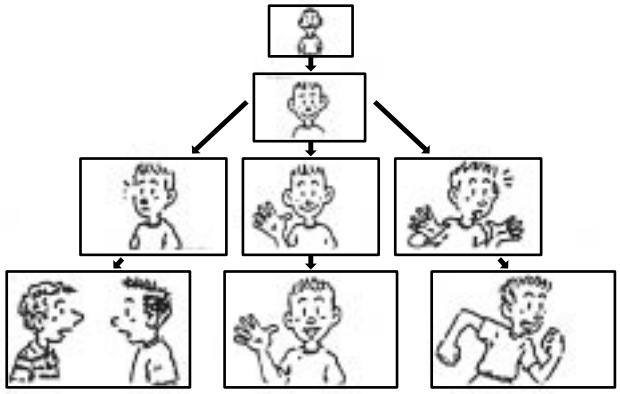
[Main Story and Subplots]



D. Branching Story Function (Simple Interactive Function)

As if it were a role playing game, it is possible to develop the story in an interactive way. For example, in a drama, you can choose the characters' next action from the menu list one after another to create a different story and/or a different ending.

[Branching Story]



(4) How to Reproduce a Multi-Story

These multi-stories can be reproduced only on discs with the recordings of a multiple number of stories that respond to each specification.
DVD discs respond to each situation's specification. Its recorded content and methods are determined by what is on the disc. Therefore, it is possible
that discs with various contents will be sold on the market. Because of this factor, we cannot now explain certain operating methods.

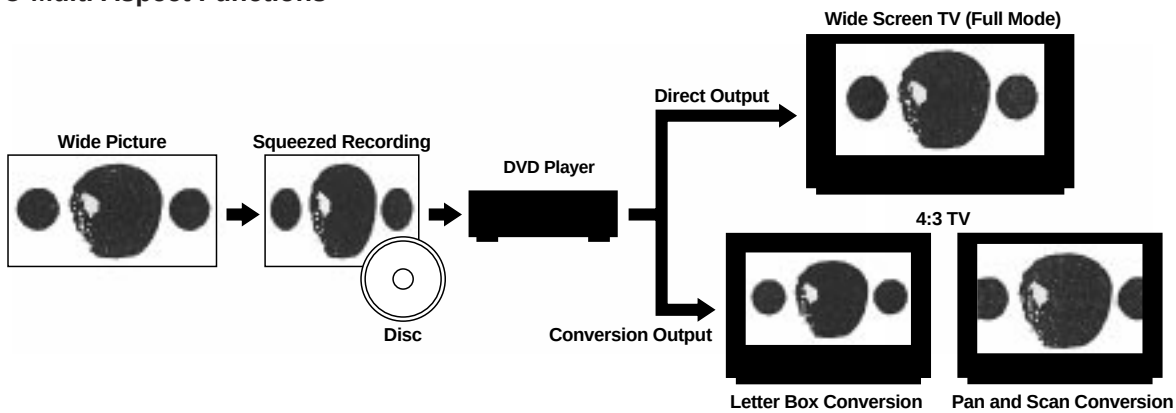
The following are the expected reproduction methods for multi-stories
① Packaging of a DVD disc that contains a reproduction method
② Choosing actions through the menu
③ Operation methods that will be shown every time they are needed, and having the viewer follows the direction(s)

3. Multi Aspect Function

With its multi-aspect function, DVD discs can be used with any type of TV.
The "Squeeze System", that compresses wide picture into the standard 4:3 ratio, will reproduce the picture in full horizontal length on a wide screen TV, so there is no deterioration in the picture quality. For big image projectors and normal TVs (4:3), a high quality picture can be reproduced with the letter box, which shrinks vertical direction, or by pan & scan, which shows a 4:3 ratio picture while cutting out the rest of the original image.
A majority of traditional "wide sized pictures" have been shown with black parts across the top and bottom of 4:3 ratio screens. Therefore, when these are projected on wide screened TV, they are widened by magnifying the picture until the black part disappears.
In such a case, the lines of resolution on the black parts were removed, reducing the lines from 425 to 360. That causes inferior picture quality.
However, "Squeeze Recording System" enables wide screen picture
reproduction that does not sacrifice any of the lines of resolution.

*However, it is entrusted to the production section of the DVD disc to choose which system to use and whether the DVD is available for letter box, pan and scan. Please note that all DVD discs can do this function.

● **Multi Aspect Functions**



3. Technical Point of DVDs

3-1 Disc Reproduction

1. Type of discs that DVD video player can reproduce

DVD video players are exclusively for reproduction, including music CDs.
DVD video discs with the following marks and music CDs are capable of being reproduced.

	Mark (logo)	Content	Size of Disc	Maximum
DVD Video Disc		Audio + Visual (animation)	12cm	One side of the disc for approx. 4 hours
				Two side of the disc for approx. 8 hours
			8cm	One side of the disc for approx. 80 minutes
				Two side of the disc for approx. 160 minutes
Music CD		Audio	12cm	74 min.
			8cm (CD Single)	20 min.
Video CD		Audio + Visual	12cm	74 min.

No discs other than those listed above can be reproduced.
This player matches the NTSC TV system. Discs shown with other TV systems (PAL, SECAM) cannot be used.

2. Authorization of DVD Video Disc (local code)

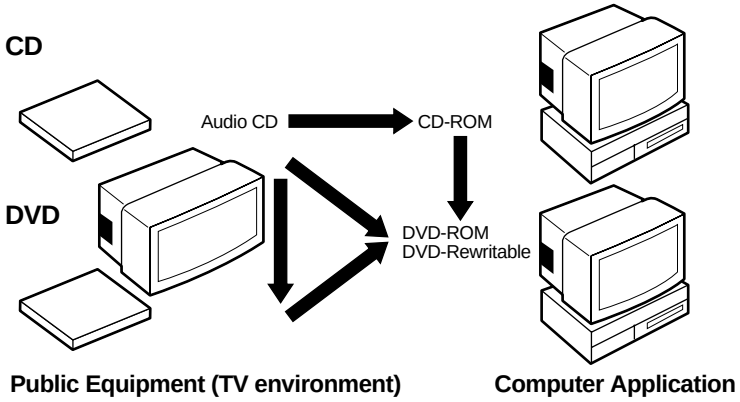
Local codes are established in different countries around the world, including Japan, U.S.A./ Canada, Asia and Europe.
Some DVD video disc have established local codes. This is the result of software production sales tactics. They make DVD video discs, especially for new movies and songs, and industrial use discs, that are to be reproduced only in official sales areas. Therefore, it is possible to see a message such that says “this disc cannot be reproduced due to the differences in local codes” when one buys a DVD video disc outside of his/her country and try to play it or industrial use videos at home.

3. Copyright Protection

To protect copyright, it is prohibited to copy, broadcast, publicly show, broadcast over a cable system, show at public lectures, or rent (whether or not charging for it) a disc. On DVD video players, copied picture won’t project as clear an image if it has been copied from another video deck.

4. The Expanding DVD World

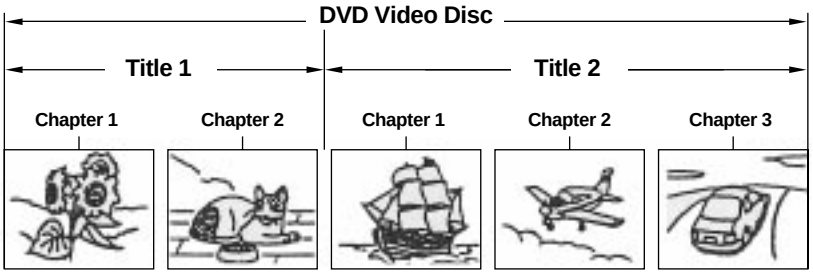
In converting music and data images into a unified file format, the border between TV and audio or computer is removed. As a result, DVD discs have many possible usages, including personal computer reproduction of DVD software and the playing of traditional audio CDs on the DVD player due to the compatibility of the hardware.



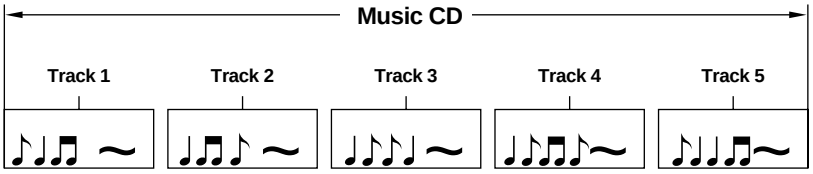
3-2 Title, Chapter, Track

DVD video discs are divided into big ends called “titles” and small ends called “chapters”. Music CDs are divided into “tracks”.

Example : For a DVD Video Disc



Example: For a Music CD



Title : A section of the DVD content divided into large parts. They correspond to the “story” part of a collection of short stories.

Chapter : Sections of the Title’s contents are divided into smaller parts, such as scenes and tunes. It corresponds to the “chapter” of a book.

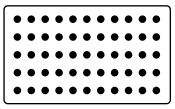
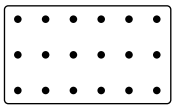
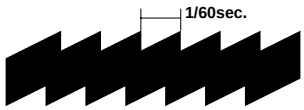
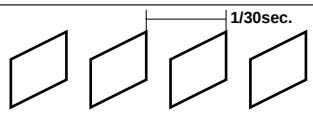
Track : A section made up of one song in a music CD.

Each title, chapter and track are numbered in order. These numbers are also called “Title Numbers”, “Chapter Numbers” and “Track Numbers”.
Some discs may not have each number recorded.

3-3 Moving Image Digital Compression Technology MPEG2 Enables Long Hour Reproduction

Even though the recording capacity of DVD discs is 7 times more than a CD, if a TV image on NTSC is digitally transferred and recorded, even the DVD disc can record only 4 minutes.
Research of the technology to record more information in a limited recording capacity (data compression) started in the 1960s. The progression has went from JPEG, MPEG1 to MPEG2.
MPEG1, which was adopted for Video CDs (karaoke, etc.), can record a maximum of 74 minutes of moving images by compressing the data to 1/100, but the picture quality is inferior to LDs.
MPEG2 offers a high quality picture by compressing the information to approximately 1/40, adding new technology to MPEG1 and increasing the compression rate. Diversified improvements include changes in the data transfer rate (variable), frame rate (double) and predicting primenumbers on corresponding pictures (double) between frames and field DCT.

Comparison of MPEG2 and MPEG1 pictures

Picture compression system (adopted equipment)	MPEG2(DVD)	MPEG1(Video CD)
Main picture degree of resolution	 720 x 480 picture pixels	 720 x 480 picture pixels
Frame Rate	 60 pictures per 1 second	 30 pictures per 1 second
Data transfer speed	1~10Mbit/sec. (variable)	1.15Mbit/sec. (fix)
Average compression rate	Approximately 1/40	Approximately 1/100
Picture quality	More than LD	About the same as VHS

*MPEG = Moving Picture Experts Group
This is the title of the compression technology working group, which is a part of the ISO/IEC Joint Technology Committee, which in turn is part of the substructure of ISO and IEC.

1. Basic idea of MPEG 2

MPEG2 commands technological skill related to compression, which is comprised of about 20 items.
It increases the amount of information not only when complicated or fast moving pictures are running (about 10Mbps),
but when slow or almost still pictures are running, it dramatically decreases the amount of information (about 1Mbps).
Overall, it attains a high quality picture with a data transfer rate of average 3.5Mbps.

2. Compression Method of Moving Pictures

When you see a TV picture, you think of it as a sequentially moving picture, thanks to the afterimage effect that "fools" our eyes. But in reality, what you are watching is a series of still pictures that move sequentially and change at a steady rate.

Therefore, it recognizes monotonous and complicated parts on still picture frames (spatial information). Than, it decreases the amount of data (higher compression) for monotonous parts and increases the amount of data (lower compression) for complicated parts.

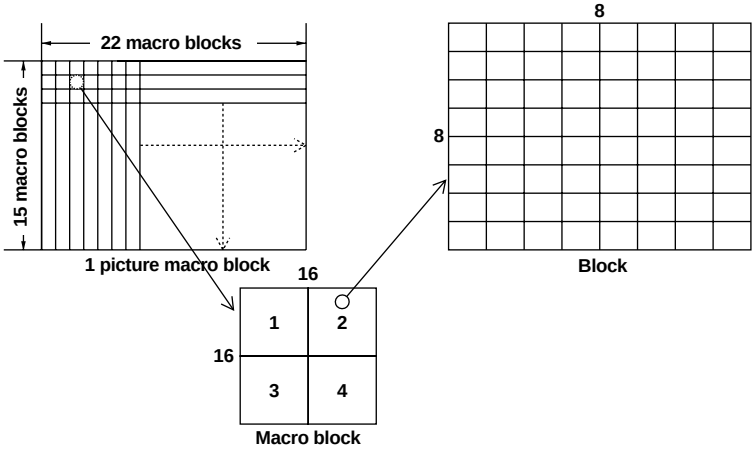
Also, since moving pictures are a succession of still pictures, the system compares each picture to the ones before it and memorizes upcoming ones in order to detect how much current picture moved. It then records only the moving part or parts (time information) as data. Reproduction is done in reverse (encode) in order to replace data (decode).

3. Steps in Spatial Information Compression (Still Picture)

(1) DCT (Discrete Cosine Transformation)

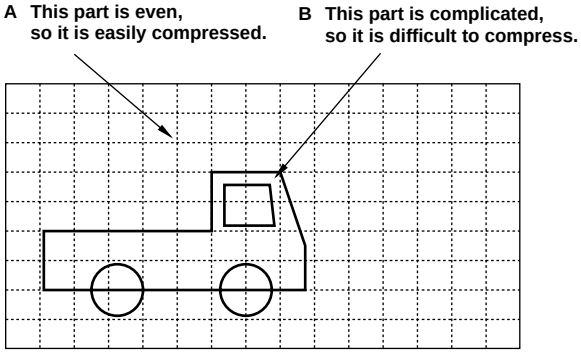
The picture is divided into small micro blocks. Each block is again divided into smaller blocks. (See the drawing below.)

Then, the complication of each picture is detected on each block, converting it into DCT = frequency, in order to sort monotonous parts (unnecessary information) from complicated parts (necessary information) by numeric value.



(2) Quantization

The data converted into numeric value (frequency) by DCT will be more compressed in its flat parts, where more information stays, by dividing it by a common value to make it quantitated.



(3) Coding

To record the quantitated numeric values more efficiently, they will be coded.
To make coding easier, the quantitated value of macro blocks will be scanned in a zigzag pattern or alternately.

① **Ranlength Coding**

Because there are a multitude of zeros (unnecessary information) in quantitated value, it does not show all the zeros. What it shows, for example, is “six 0s” when there are 6 consecutive zeros.

② **Valuable length coding**

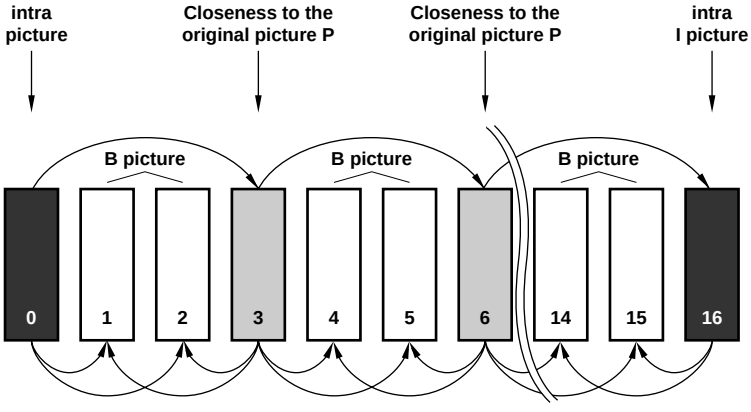
Code is shown in binary numbers. Frequently showing numbers gets the shortest code, and rarely appearing numbers get longer code in order to decrease the overall amount of data.

4. Steps for Time Information Compression (Moving Picture)

Compression of moving pictures is done the same it is for still pictures.
Pictures are divided in macro blocks, and the movement changes on each block is “detected”, “predicted” and “corrected”. Also, assuming there are many occasions when entire pictures will be replaced by different ones, non-compressed original pictures (I picture) and less compressed pictures (P picture) are inserted in frames at regular intervals. The pictures between them will be inserted between these frames by predicting former and latter I and P pictures.

(1) Inserting original pictures between frame assumption

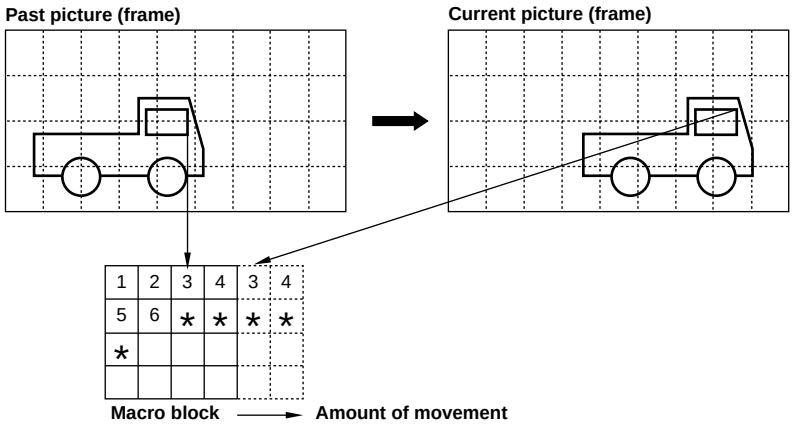
When an entire picture changes (random search, etc.), “detection”, “prediction” and “correction” of the movement cannot be made.
Therefore, original pictures (intra = I picture) are inserted at intervals of every 6 to 15 frames and predicted pictures (P picture) from I picture every 2 to 6 frames.
Also, mutually predicted pictures among the I and P picture (bi-directionally = B picture) are inserted between these I and P pictures.
B pictures (frames) on 1 ~ 2 below are predicted and made from I picture (frames) and P pictures on 0 and 3.



Example: Inserting I every 16 frames and P in every 3 frames.

(2) Movement [Detection]

The system detects each macro block and compares the current picture to the past memorized ones, and compiles data about the direction and distance of movement vectors.



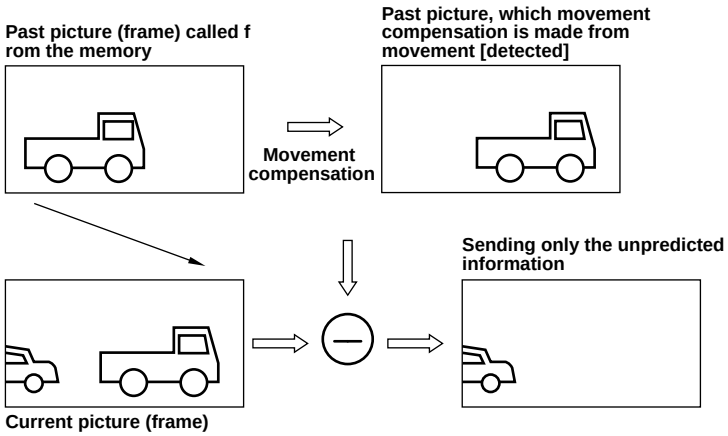
It detects which square (block) corresponds to this one in the previous picture and measures the moved amount and directional vectors.

(3) Movement Compensation Prediction

There are parts similar in previous and successive pictures. Therefore, it is not necessary to transfer every bit of information on the current picture, since similar parts of the previous picture can be used.

To determine what content of the current picture is to be transferred, prediction is made by comparing the amount and direction of movement in the previously memorized picture and the current one.

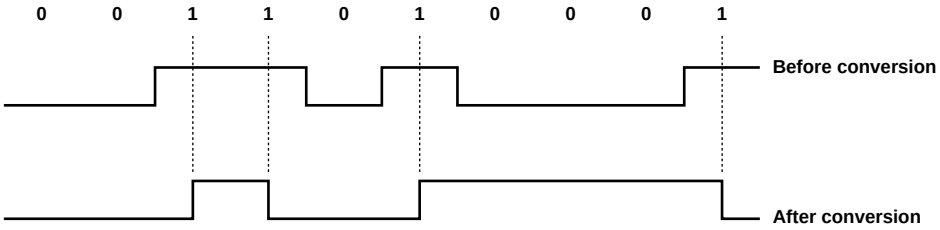
Then, only the parts with margin of error, meaning the parts that changed and/or were added, are recorded.


Past picture (frame) called f rom the memory
Past picture, which movement compensation is made from movement [detected]
Movement compensation
Sending only the unpredicted information
Current picture (frame)

3-4 8/16 Modulation

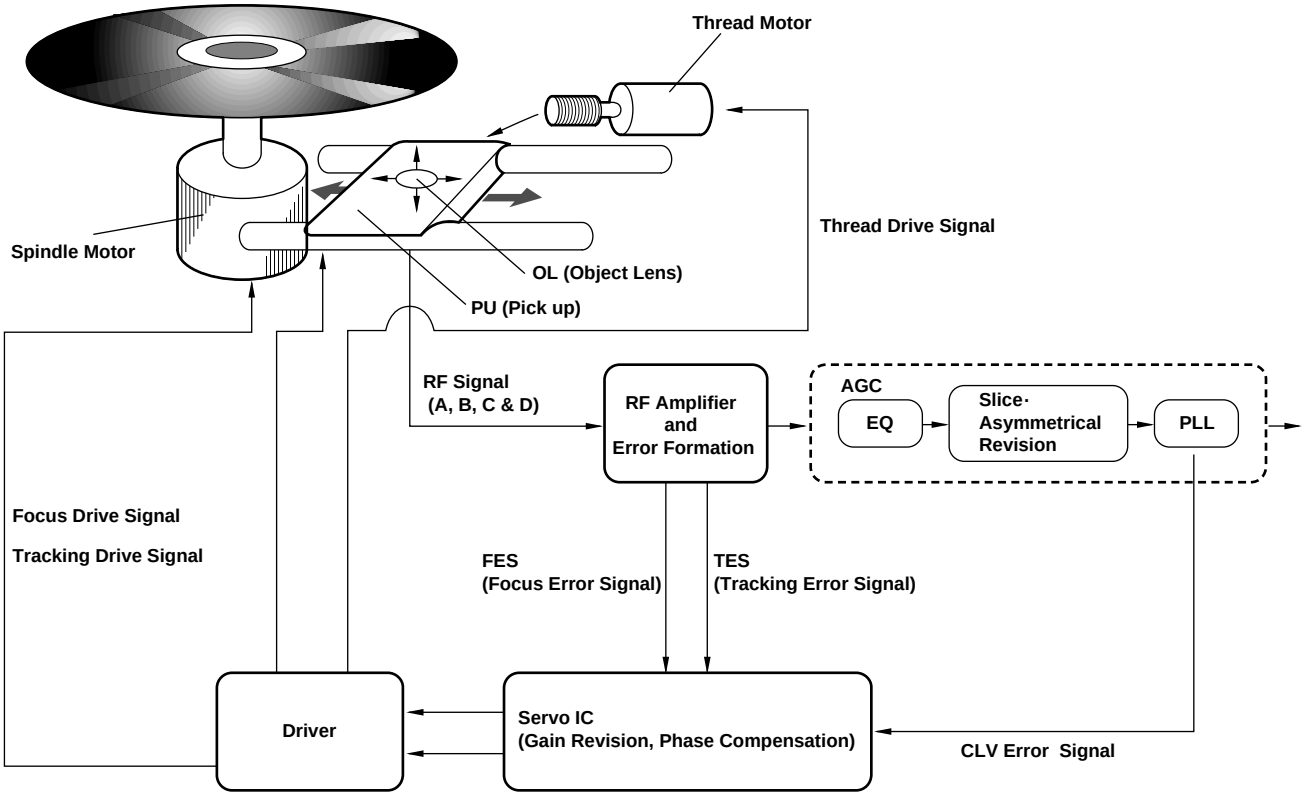
When the part without a pit continues to track a disc, it becomes difficult to create a laser spot to follow based on a pit. Also, it is difficult to judge how many 0s and 1s are being followed. Therefore, it is necessary to limit the length of the part without a pit on the track. That means, it is necessary to limit the succession of 0s and 1s.

8/16 modulation converts the original 8 bit data into 16 bit to limit the succession of “0s” or “1s” from 3 to 11. Also, NRZI modulation makes both of the pit edges a “1”. With this, code reading and recording density accuracy increases. (See below)



4. DVD Servo Circulation

4-1 Outline of Disc Servo



1. Focus Servo

- Move OL up and down to focus on the disc pit.
- Disc (DVD) face shake ± 300μm
  Accuracy of Turn Table 150μm p-p ➡ Suppression under ± 0.23μm

2. Tracking Servo

- Move the Object Lens between the internal and external circumference (at a right-angle to the track) to place the beam on the track.
- Disc (DVD) core 100μm p-p
  Core at TT, fastened 50μm p-p ➡ Suppression under ± 0.022μm

3. Thread Servo

- Because the object lens' movement is small (about ± 0.35m/m in the tracking direction), the entire pick-up is moved near the target track with the thread motor.
- In normal reproduction, it is necessary to make a fine movement, in which the object lens stays around a free neutral point. In this case, it is necessary to make a high-speed move in order to suppress object lens vibration.

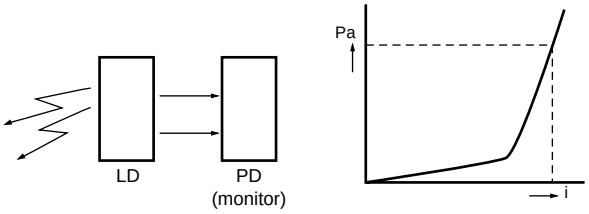
4. Spindle Servo

- Rotate the disc under Constant Linear Velocity (CLV).
- Control is necessary to make quick invariable line speed when making a pick-up move when in the seek mode.

Invariable rotation on MO/HD ➡ For making faster access
CLV ➡ For changing the disc rotation speed depending on the pick-up position (faster on the interior side (1400rpm) and slower on the exterior side (580rpm))

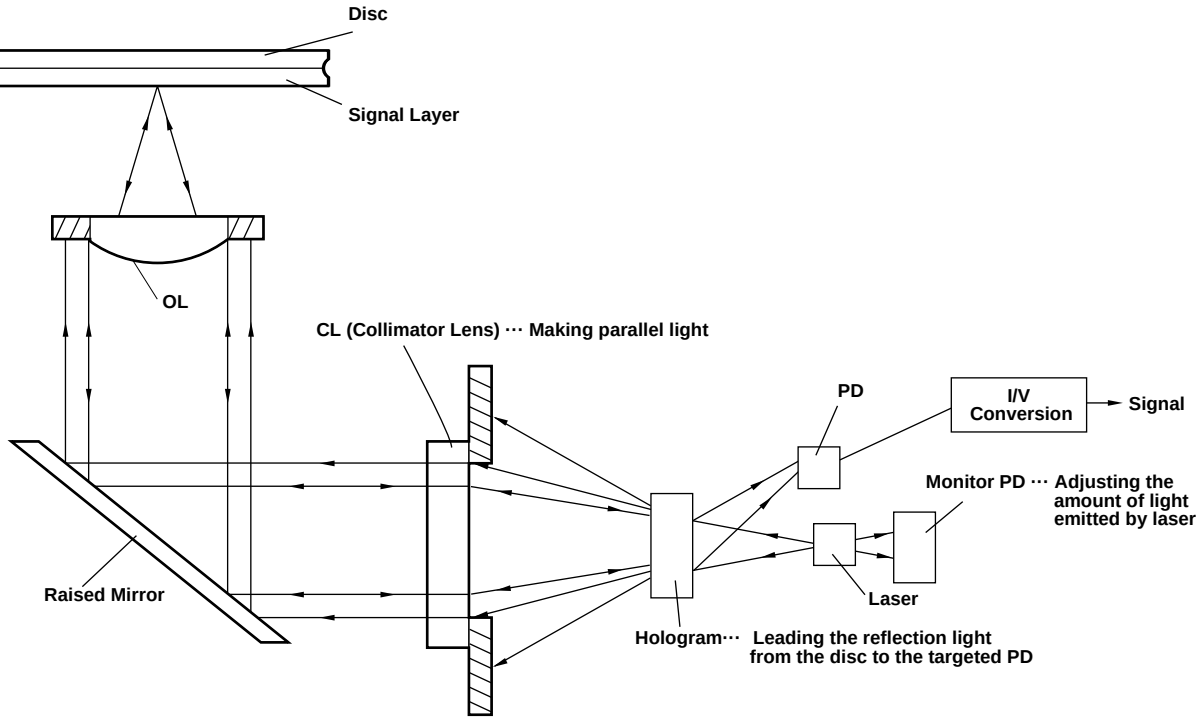
5. Automatic Power Control (APC)

- On laser, the amount of light being emitted changes greatly, even when the running electric current only varies slightly. Therefore, the amount of omitted light is detected on the Photo Detector in order to monitor and control the stability of the laser current.



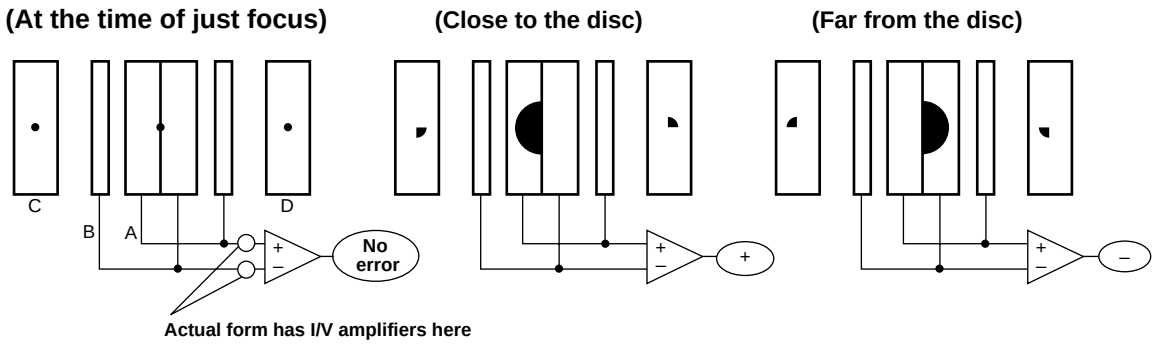
4-2 How to Make the Error Signal

1. Optical System of Hologram Pick-Up



2. How to Make FES (Focus Error Signal) · · · Hologram Foucault Method

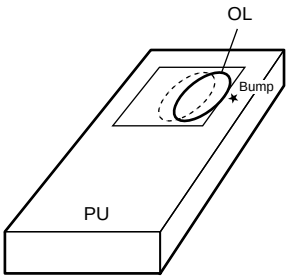
Note: The following PD form is slightly different from the actual one. (image only)



- From the deviation of focus, the light shown above (black part) comes back on PD. By receiving the output through a differential amplifier, DC voltage, which responded to defocusing, is output.

3. How to Make Thread Error Signal

When thread does not move.....

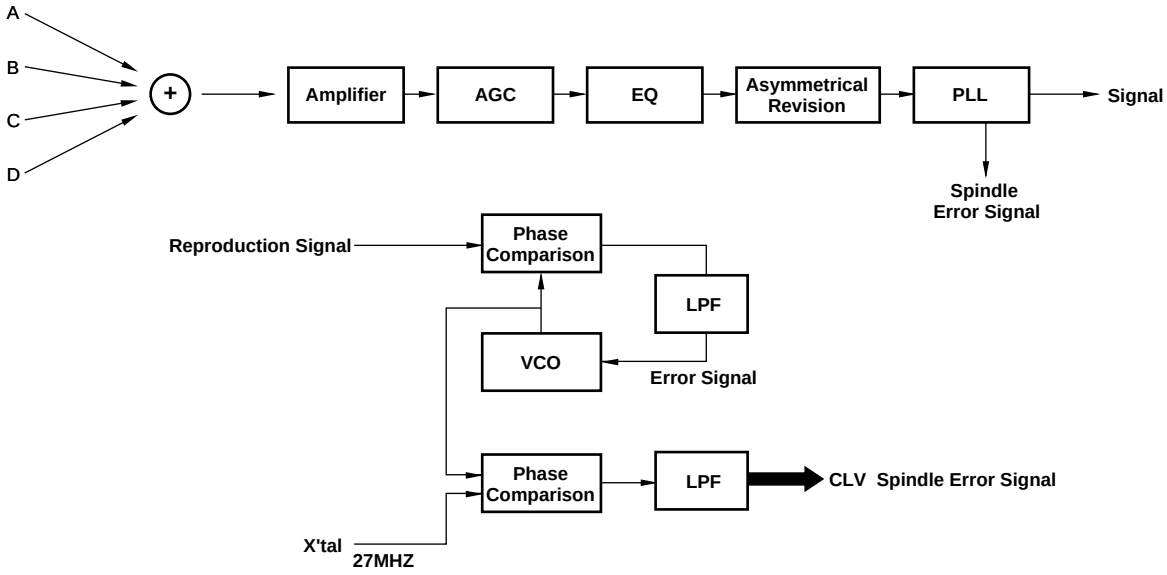


Take out the low frequency component for tracking error signals.
Tracking Error Signal ➡ LPF ➡ Thread Error Signal
With this, move the thread to make OL stay around the free neutral point.

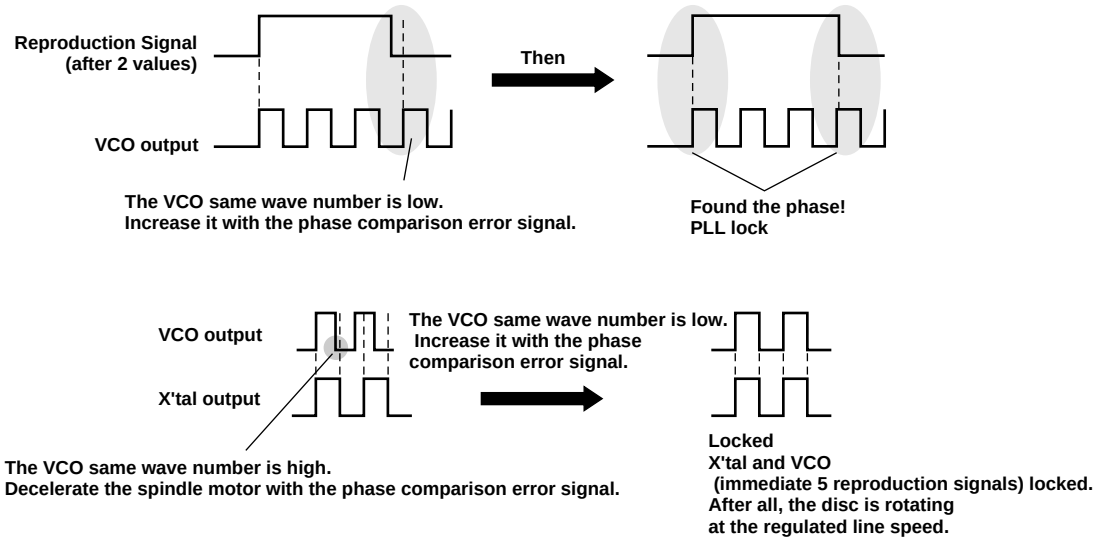
4. How to Make Spindle Error Signal

- Due to CLV control, error signals come from the reproduction signal.

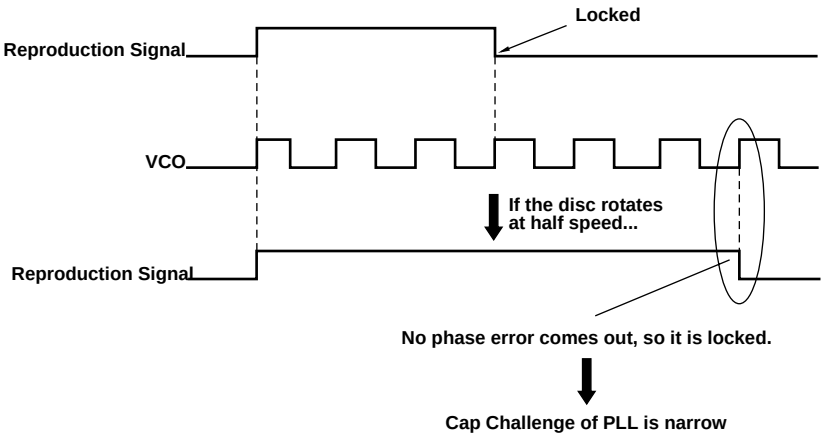
DVD: approx. 580rpm ~ 1400rpm CD: 200rpm ~ 460rpm



<Wave shape Image>


Reproduction Signal (after 2 values)
VCO output
Then
The VCO same wave number is low.
Increase it with the phase comparison error signal.
Found the phase!
PLL lock
VCO output
X'tal output
The VCO same wave number is low.
Increase it with the phase comparison error signal.
The VCO same wave number is high.
Decelerate the spindle motor with the phase comparison error signal.
Locked
X'tal and VCO
(immediate 5 reproduction signals) locked.
After all, the disc is rotating
at the regulated line speed.

However....


Locked
Reproduction Signal
VCO
If the disc rotates at half speed...
Reproduction Signal
No phase error comes out, so it is locked.
Cap Challenge of PLL is narrow

Because of that ⋯
Rough Servo is needed at the start

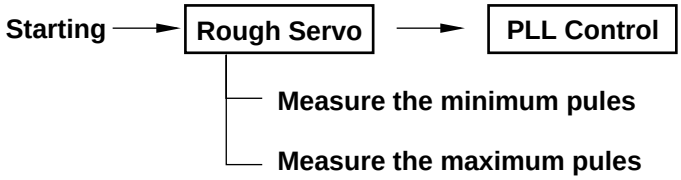
There are many reproduction signal lengths.

DVD 3T ~ 14T
CD 3T ~ 11T

➡ T means 1 cycle of the channel clock. 3T means 3 times as long as that.

Because the length of T is different even for the same 3T, pulse lengths are different.
A CD is approximately 6 times as much as a DVD.

● Measure the lengths of the minimum and maximum reproduction signals, then switch to PLL operation after it almost reaches the targeted number of rotations (after getting in the cap challenge of PLL)



4-3 Automatic Adjustment

- Automatic adjustment is executed every time the disc changes. (7 to 8 seconds later)
  Why? Because

➡ ● reflection rates, etc. differ on different discs
  ● it absorbs laser power, PD, an optical system changes with the passage of time, etc.
  ● of the need to decrease adjustment at the time of production

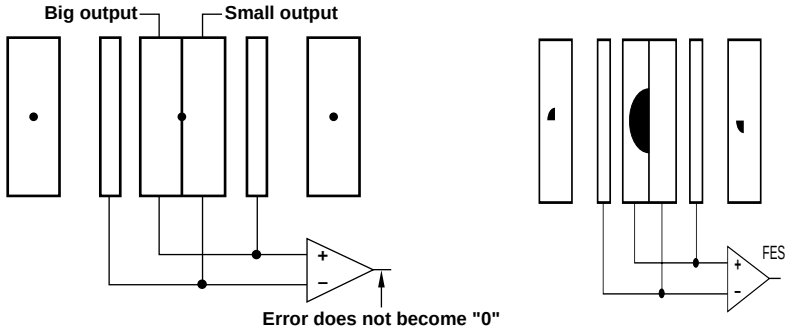
The Following Adjustments are Actually Executed

1. Offset Adjustment

- While the light doesn't return the laser condition, the laser and adjusts the TES and FES to a standard voltage.
  (It revises the electric offset on error formation circuits)

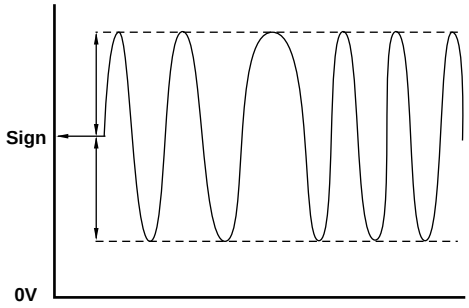
2. Focus Bias Adjustment

- If there are differences in the reception of the PD as shown, even if the focus on the disc is at optimum condition, error signals do not become "0".
  Therefore, bias is added to the FES signal, then the RF amplitude signal reaches its maximum, or zitta seeks the best bias voltage to achieve a revised bias voltage.



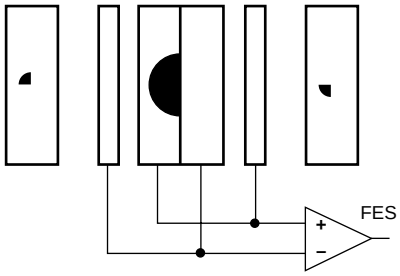
3. Tracking Balance Adjustment

- Similarly, in tracking, error "0" level revisions are made.
  When rotating the disc in the Focus Servo "ON", Tracking Servo "OFF" and Thread Servo "OFF" modes, TES shows up due to the polarized core of the disc. Revise it to make the voltage of the half of the p-p value to be error "0".



4. Focus Gain Adjustment

- Depending on the disc reflection rate, PD sensitivity difference, etc, FES output voltage changes against a certain amount of focus gap.
  For example, if FES becomes 1/2 of the same amount as the focus gap, servo output voltage reduces to half to revise it.
  That means, the gain decreased 6dB.
  The method to adjust the gain for this condition is to add a “gairan” of a certain frequency to the focus servo group, compare the FES and added “gairan” levels phase, and revise the gain in the servo IC to reach the targeted gain.



5. Tracking Gain Adjustment

- Similarly, gain adjustment is done through the tracking servo system

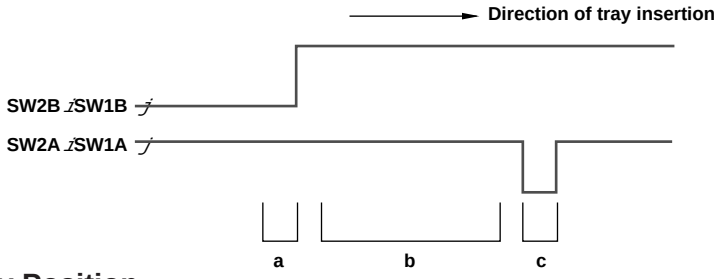
5. TRAYMECHA Control

5-1 Position of TRAYMECHA

The TRAHMECHA position is detected by turning on 5 of SW.
However, there are some cases when the position of the TRAYMECHA cannot be detected with SW input information only. In such a case, it is possible to specify the position from the condition of the SW input change when tray motor is rotated one direction or the other.
The following are the input conditions responding to each TRAYMECHA position.
Terms in parenthesis show the condition of switches responding to the tray 2 side.

- **5 of SW input**
  SW2A, SW2B, SW1A, SW1B, MECHSW

1. Tray 1, 2 open/close



(1) Open Tray Position

Position where SW2B (SW1B) fall is detected while tray discharge is activating.

(2) Tray Insert/Discharge Position

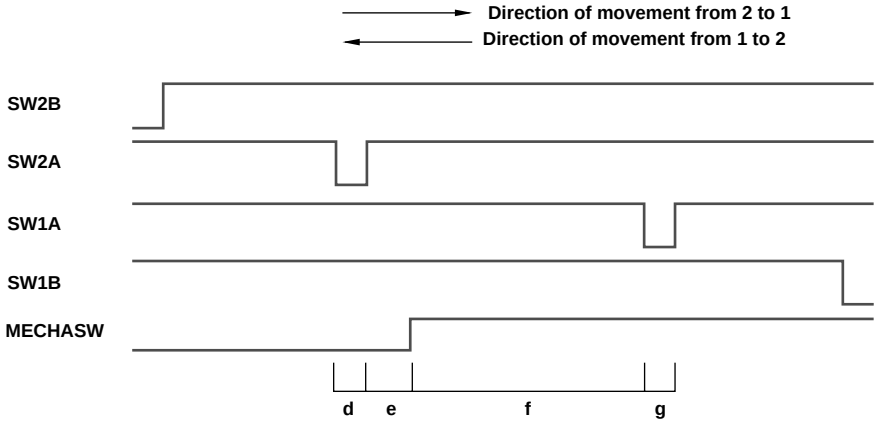
Both SW2B (SW1B), SW2A (SW1A) are under condition “H”, and during this period (while the motor is rotating), MECHASW does not change from “H” (while Tray 2 is in action) or “L” (while Tray 1 is in action).

(3) Closed Tray Position

The position where SW2A (SW1A) fall is detected while the tray is activating.

Note: While Tray 1 is in action, disc reproduction is possible when MECHASW is “L” and PICKMECHA is on the Tray 2 side. On the other hand, while Tray 2 is in action, disc reproduction is possible when MECHASW is “H” and PICKMECHA is on the Tray 1 side

2. Moving PICKMECHA from Tray 2 Side to Tray 1 Side.



(1) Position of concluded PICKMECHA transfer from the Tray 1 side to the Tray 2 side. The position where SW2A fall is detected while PICKMECHA is moving from the Tray 1 side to the Tray 2 side.

(2) Position of PICKMECHA during movement (from either side to the other side) SW1A, SW1B, SW2A and SW2B are all in “H”, and MECHASW changes from “H” to “L”, or “L” to “H” during this time (while the motor is running).

(3) Position of concluded PICHKECHA transfer from the Tray 2 side to the Tray 1 side The position where SW1A fall is detected while PICKMECHA is moving from Tray 2 side to Tray 1 side.

5-2 TRAYMECHA Movement at Initialization (Loading Motor operation is in low-speed mode)

(1) Tray opening (initialization from MECHA position a)

Insert the tray and move it to c: tray close position. (both Trays 1 and 2)

(2) Tray insert/discharge

Insert the tray and move it to c: tray close position.

(3) Tray closing

The current position marks the completion of movement and the treatment is over.

(4) PICKMECHA movement completed from Tray 1 side to Tray 2 side

It is the same position as Tray 1 Close, so the movement is complete and the treatment is over.

(5) When PICKMECHA is between Trays 1 and 2, and MECHASW = “L”

Rotate the loading motor in the direction of PICKMECHA movement from the Tray 2 side to the Tray 1 side, then reverse it when MECHASW = “H” is detected. After that, PICKMECHA movement is completed from d: Tray 1 side to Tray 2 side.

(6) When PICKMECHA is between Trays 1 and 2, and MECHASW = “H”

Move PICKMECHA from the Tray 1 side to the Tray 2 side, then d: move it to the PICKMECHA completion position from the Tray 1 side to the Tray 2 side.

5-3 Loading Motor Control

To move the TRAYMECHA position, control the loading motor driver IC with the 2 control signal output.

- LOAD + Loading motor is running forward
- LOAD – Loading motor is running in reverse

Output is made following the logic listed below:

Output Signal / Loading Condition	Loading Running Forward	Loading Running in Reverse
Loading Halt	L	L
Loading Running Forward	H	L
Loading Running in Reverse	L	H
Loading Brake	H	H

However, the following high and low-speed modes are to be adopted in good command.

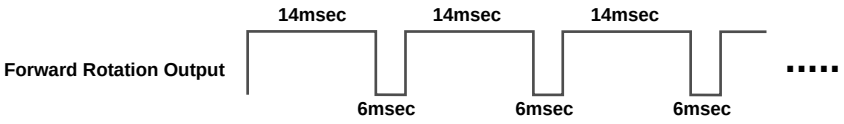
(1) High-speed mode

Constant drive (Forward output is “H” while running forward. Reverse output is “H” while running in reverse.)

(2) Low-speed mode

Execute output while setting rotation output (forward and reverse) and stop output as a pulse condition, then rotate it under low-speed motor.

The pulse cycle is set to be 14m/sec for rotation output and 6m/sec for stop output.



5-4 Tray 1 Insert Action

While Tray 1 is “close”, start the Tray 1 discharge action via key operation. Start the loading motor with high-speed mode for reverse rotation, then change it to low-speed mode for reverse rotation 1.2 second after the detection of the rise of SW2A. g:then, move it to the Tray 1 “open” position. If the discharge action is not completed in 6 seconds, it stops once and begins reverse insert action.

5-5 Tray 1 Discharge Action

While Tray 1 is “open”, start the Tray 1 insert action via key operation or by detecting SW2B input rise. Start the loading motor with high-speed mode for forward rotation, then change it to low-speed mode for forward rotation 1.2 second after the detection of the rise of SW2B. Then, move it to the Tray 1 “close” position.

If the insert action is not completed in 6 seconds, it stops once and begins reverse discharge action.

5-6 Tray 1 Reverse Action

(1) While Tray 1 is inserted, start the Tray 1 discharge action via operating keys. After the Brake Mode has been on for 150msec, start the loading motor in low-speed mode for reverse, then move the tray to the Tray 1 “open” position.

(2) While Tray 1 is discharged, start Tray 1 insert action via operating keys.
After the Brake Mode has been on for 150msec., start the loading motor in low-speed forward mode, then move the tray to the Tray 1 “close” position.

5-7 Tray 2 Insert Action

While Tray 2 is “open”, start the Tray 2 insert action via key operation or by detecting SW1B input rise. Start the loading motor with high-speed mode for reverse rotation, then change it to low-speed mode for forward rotation 1.2 second after the detection of the rise of SW1B. c:then, move it to the Tray 2 “close” position.

If the insert action is not completed in 6 seconds, it stops once and begins reverse discharge action.

5-8 Tray 2 Discharge Action

While Tray 2 is “close”, start the Tray 2 discharge action via key operation. Start the loading motor with high-speed mode for forward rotation, then change it to low-speed mode for forward rotation 1.2 second after the detection of the rise of SW1A. a:then, move it to the Tray 1 “open” position.

If the discharge action is not completed in 6 seconds, it stops once and begins reverse insert action.

5-9 Tray 2 Reverse Action

(1) While Tray 2 is inserted, start the Tray 2 discharge action via operating keys. After the Brake Mode has been on for 150msec, start the loading motor in low-speed mode for forward, a:then move the tray to the Tray 2 “open” position.

(2) While Tray 2 is discharged, start Tray 2 insert action via operating keys.
After the Brake Mode has been on for 150msec., start the loading motor in low-speed reverse mode, c:then move the tray to the Tray 2 “close” position.

5-10 PICKMECHA Moving Action from the Tray 1 to the Tray 2 side

With Tray 2 “closed” (or when PICKMECHA has finished moving from the Tray 2 side to the Tray 1 side), start the moving action of PICKMECHA from Tray 1 side to the Tray 2 side by key operation.

Start the loading motor under high-speed mode. After 1.2 second from detection of the rise in SW1A input, set reverse low-speed mode, d: then move PICKMECHA to the end position from the Tray 1 to the Tray 2 side.

5-11 PICKMECHA Moving Action from the Tray 2 to the Tray 1 side

With Tray 1 “closed” (or when PICKMECHA has finished moving from the Tray 1 side to the Tray 2 side), Start the moving action of PICKMECHA from Tray 2 side to the Tray 1 side by key operation.

Start the loading motor under high-speed mode for forward. After 1.2 second from detection of the rise in SW2A input, set forward low-speed mode, g: then move PICKMECHA to the end position from the Tray 2 to the Tray 1 side.

5-12 PICKMECHA Reverse Action

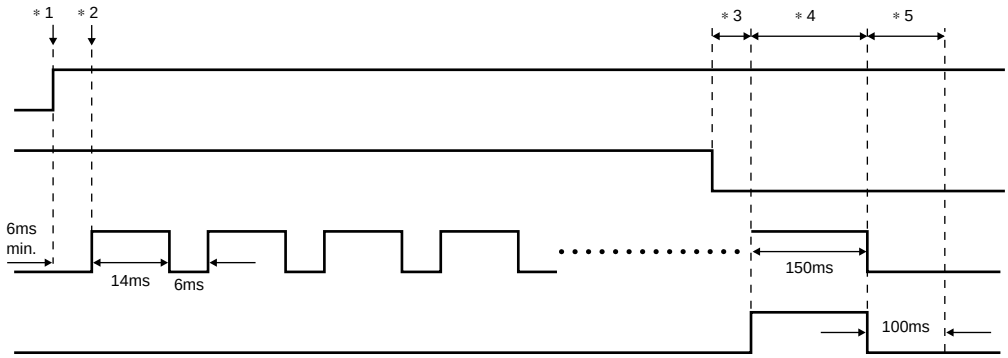
(1) While moving PICKMECHA from the Tray 1 to the Tray 2 side, start PICKMECHA movement from the Tray 2 side to the Tray 1 side by key operation. After Brake Mode has been on for 150msec., start loading motor in low-speed forward mode, g: then move PICKMECHA to the end position from the Tray 2 to the Tray 1 side.

(2) While moving PICKMECHA from the Tray 1 to the Tray 2 side, start PICKMECHA movement from the Tray 2 side to the Tray 1 side by key operation. After Brake Mode has been on for 150msec., start loading motor in low-speed forward mode, d: then move PICKMECHA to the end position from the Tray 2 to the Tray 1 side.

6. TRAYMECHA Timing Chart

TRAYMECHA Timing Chart (1)

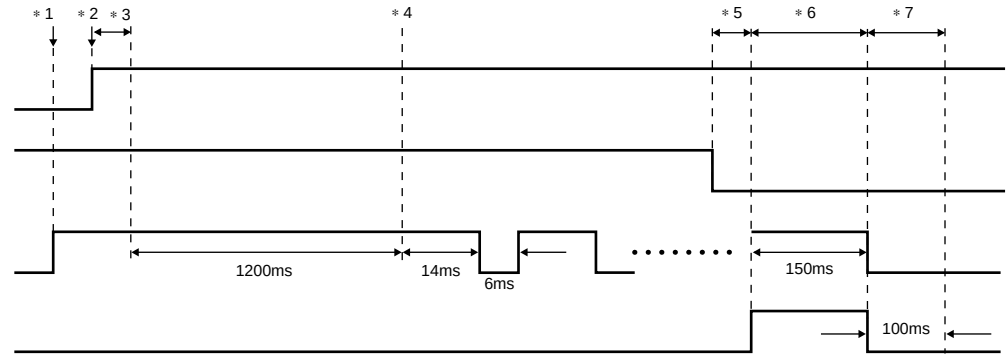
Condition of working	When Tray 1 is manually inserted
Working Mode	Tray 1 Open ➡ Tray 1 Close



*1. Active point of SW2B by manual insert
*2. Recognition point of SW2B"H" (Starting point of loading)
*3. Recognition time of SW2A"L"
*4. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW2A turns to "H" during this time, reverse pulse drive is operated. When SW2A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*5. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (2)

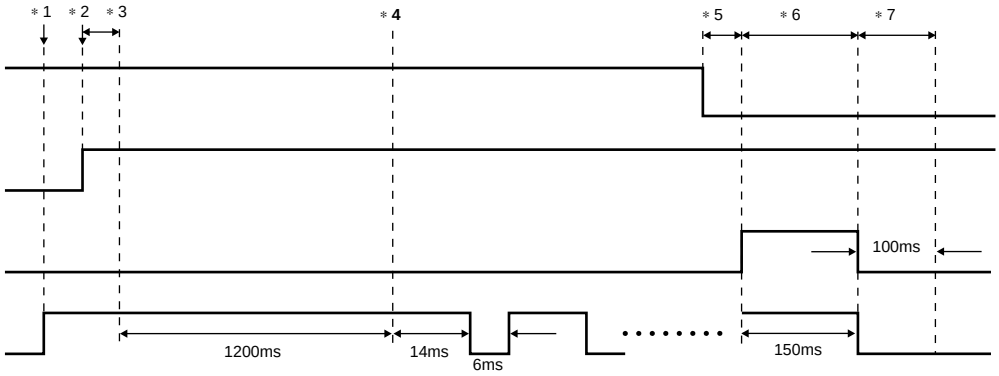
Condition of working	When Tray 1 is manually inserted
Working Mode	Tray 1 Open ➡ Tray 1 Close



*1. Point of loading to start with key operation
*2. Active point of SW2B
*3. Recognition time of SW2B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Recognition time of SW2A"L"
*6. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW2A turns to "H" during this time, reverse pulse drive is operated. When SW2A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*7. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (3)

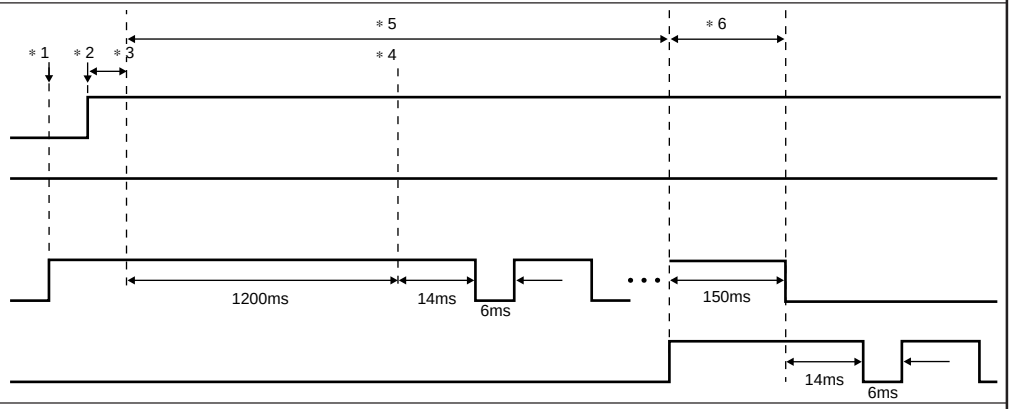
Condition of working	When Tray 1 is discharged
Working Mode	Tray 1 Colse ➡ Tray 1 Open



*1. Point of unloading to start
*2. Active point of SW2A
*3. Recognition time of SW2A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Recognition time of SW2B"L"
*6. Short break time for loading motor
*7. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (4)

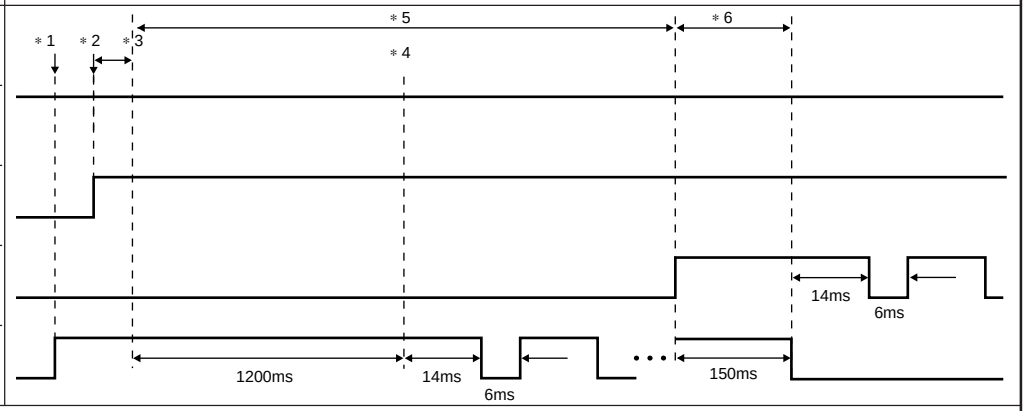
Condition of working	When Tray 1 is Inserted and Reversed
Working Mode	Inserting Tray 1 ➡ Adding external pressure of Tray 1 ➡ Discharge of Tray 1



*1. Point of loading to start with key operation
*2. Active point of SW2B
*3. Recognition time of SW2B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Mechanic action over time (6 seconds)
*6. Short break time for loading motor

TRAYMECHA Timing Chart (5)

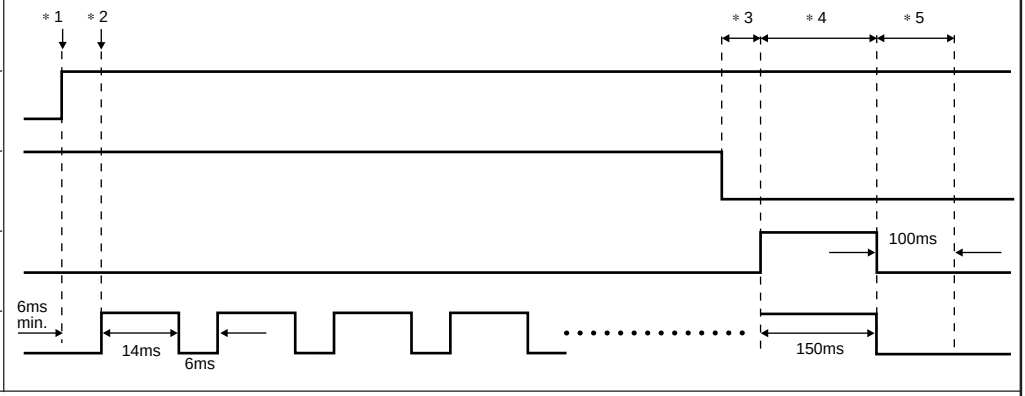
Condition of working	When Tray 1 is discharged
Working Mode	Discharge of Tray 1 ➡ Adding external pressure of Tray 1 ➡ Inserting Tray 1



*1. Point of unloading to start
*2. Active point of SW2A
*3. Recognition time of SW2A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Mechanic action over time (6 seconds)
*6. Short break time for loading motor

TRAYMECHA Timing Chart (6)

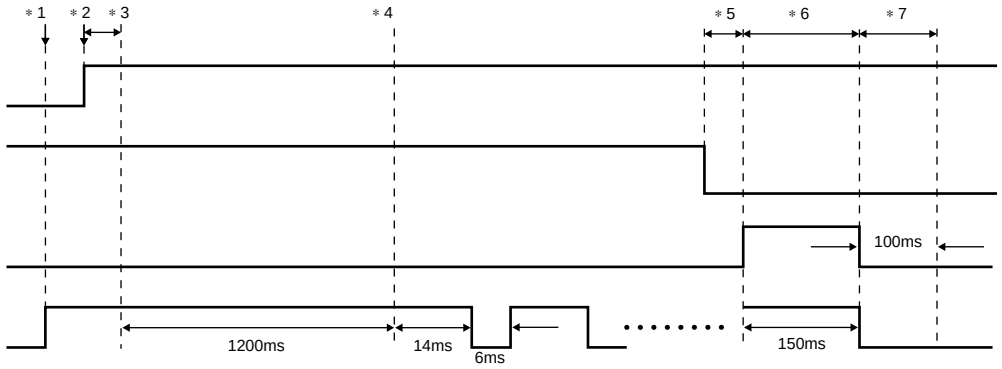
Condition of working	When Tray 2 is discharged
Working Mode	Tray 2 Open ➡ Tray 2 Colse



*1. Active point of SW1B by manual insert
*2. Recognition point of SW1B"H" (Starting point of loading)
*3. Recognition time of SW1A"L"
*4. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW1A turns to "H" during this time, forward pulse drive is operated. When SW1A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*5. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (7)

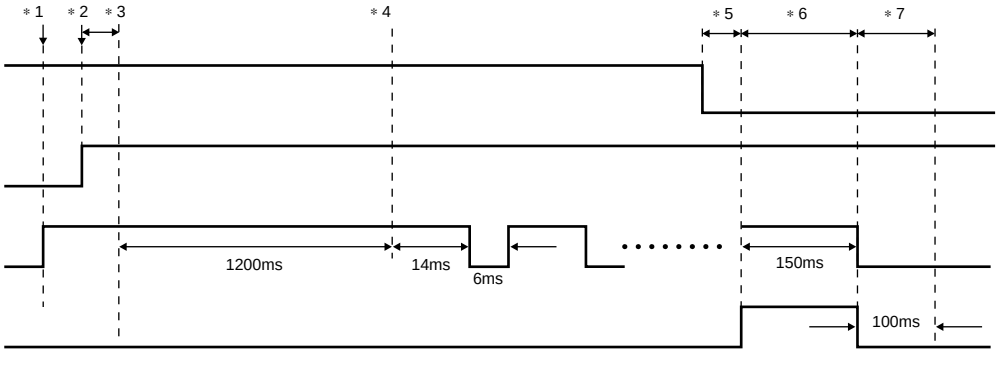
Condition of working	When Tray 2 is discharged
Working Mode	Tray 2 Open ➡ Tray 2 Colse



*1. Point of loading to start with key operation
*2. Active point of SW1B
*3. Recognition time of SW1B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Recognition time of SW1A"L"
*6. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW1A turns to "H" during this time, forward pulse drive is operated. When SW1A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*7. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (8)

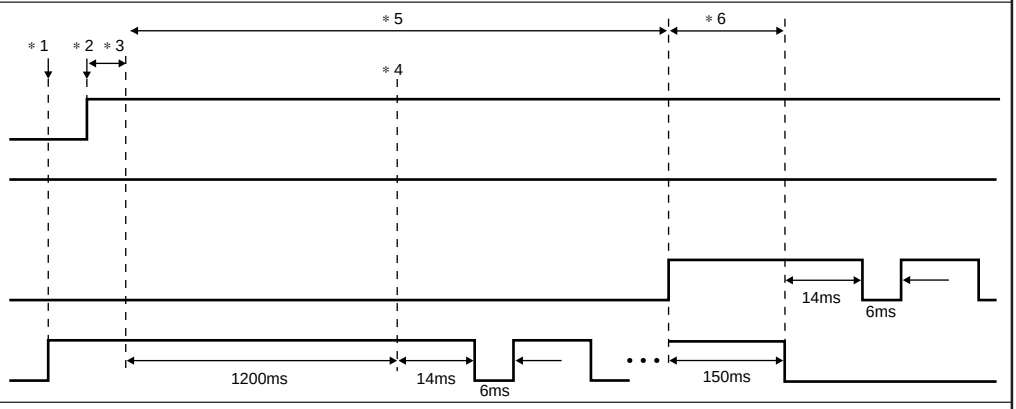
Condition of working	When Tray 2 is discharged
Working Mode	Tray 2 Colse ➡ Tray 2 Open



*1. Point of unloading to start
*2. Active point of SW1A
*3. Recognition time of SW1A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Recognition time of SW1B"L"
*6. Short break time for loading motor
*7. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (9)

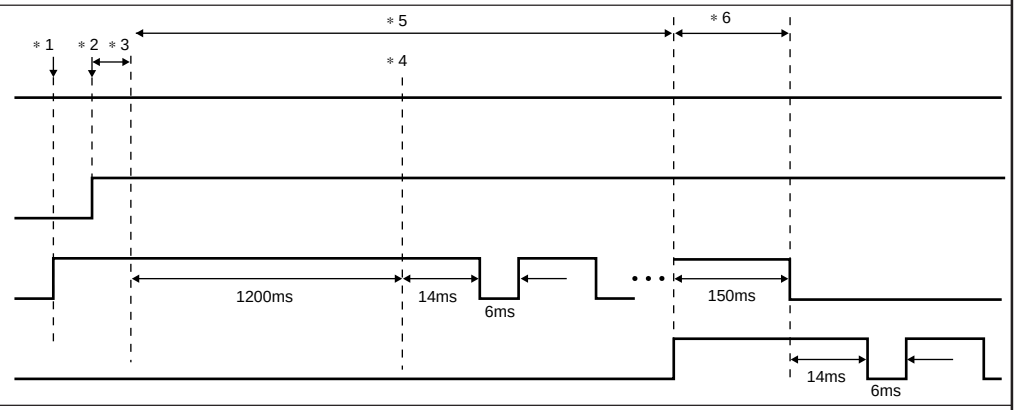
Condition of working	When Tray 2 is Inserted and Reversed
Working Mode	Inserting Tray 2 ➡ Adding external pressure of Tray 2 ➡ Discharge of Tray 2



*1. Point of loading to start with key operation
*2. Active point of SW1B
*3. Recognition time of SW1B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Mechanic action over time (6 seconds)
*6. Short break time for loading motor

TRAYMECHA Timing Chart (10)

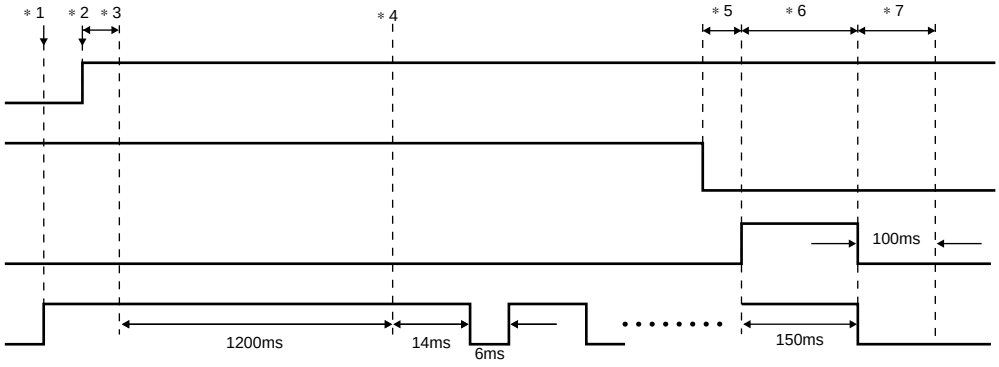
Condition of working	When Tray 2 is discharged
Working Mode	Discharge of Tray 2 ➡ Adding external pressure of Tray 2 ➡ Inserting Tray 2



*1. Point of unloading to start
*2. Active point of SW1A
*3. Recognition time of SW1A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Mechanic action over time (6 seconds)
*6. Short break time for loading motor

TRAYMECHA Timing Chart (11)

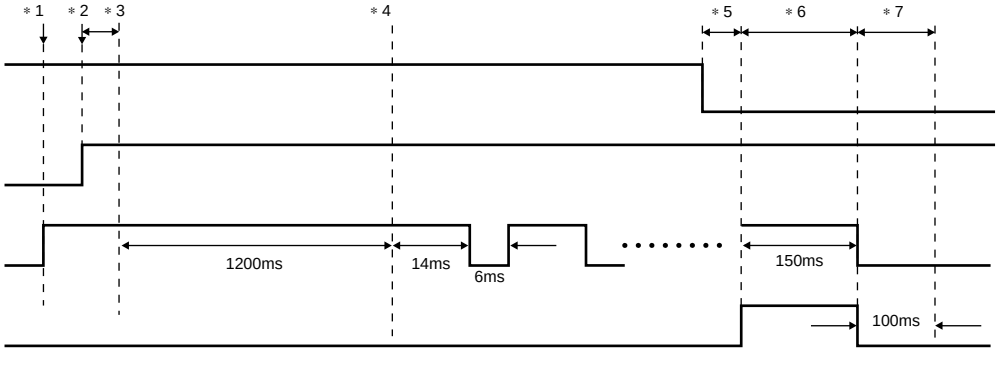
Condition of working	When PICKMECHA is moving from the Tray 1 to the Tray 2 side
Working Mode	Tray 2 Close ➡ PICKMECHA moves from the Tray 1 to the Tray 2 side



*1. Point where PICKMECHA starts to move
*2. Active point of SW1A
*3. Recognition time of SW1A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Recognition time of SW2A"L"
*6. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW2A turns to "H" during this time, forward pulse drive is operated. When SW2A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*7.Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (12)

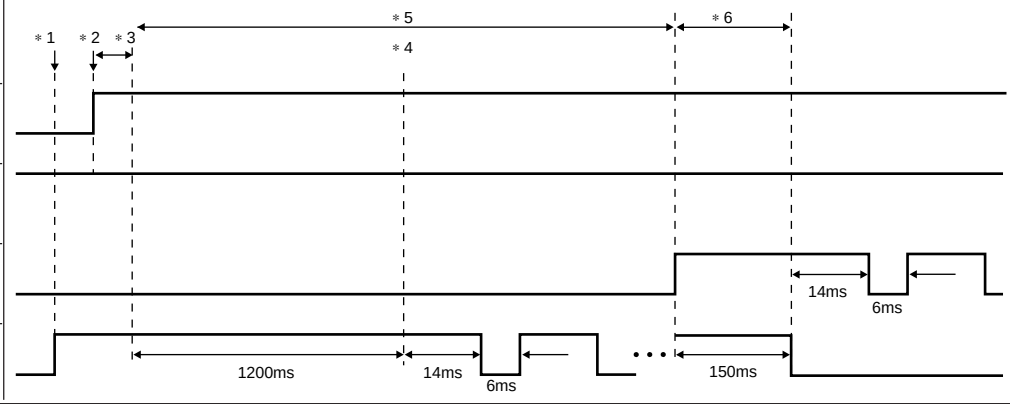
Condition of working	When PICKMECHA is moving from the Tray 2 to the Tray 1 side
Working Mode	Tray 1 Close ➡ PICKMECHA moves from the Tray 2 to the Tray 1 side



*1. Point of unloading to start
*2. Active point of SW2A
*3. Recognition time of SW2A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Recognition time of SW1A"L"
*6. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW1A turns to "H" during this time, reverse pulse drive is operated. When SW1A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*7. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (13)

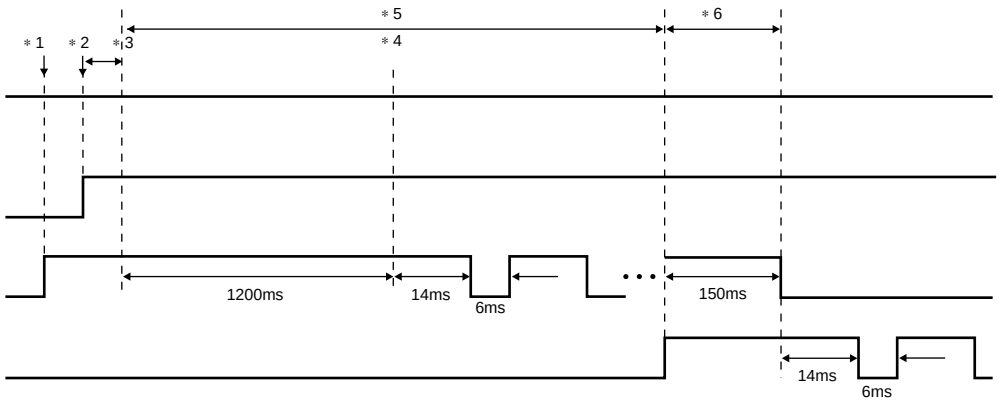
Condition of working	PICKMECHA movement to reverse from the Tray 1 to the Tray 2 side
Working Mode	PICKMECHA moves from the Tray 1 to the Tray 2 side ➡ External pressure placed on PICKMECHA ➡ PICKMECHA moves from the Tray 2 to the Tray 1 side



*1. Point of loading to start with key operation
*2. Active point of SW1A
*3. Recognition time of SW1A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Mechanic action over time (6 seconds)
*6. Short break time for loading motor

TRAYMECHA Timing Chart (14)

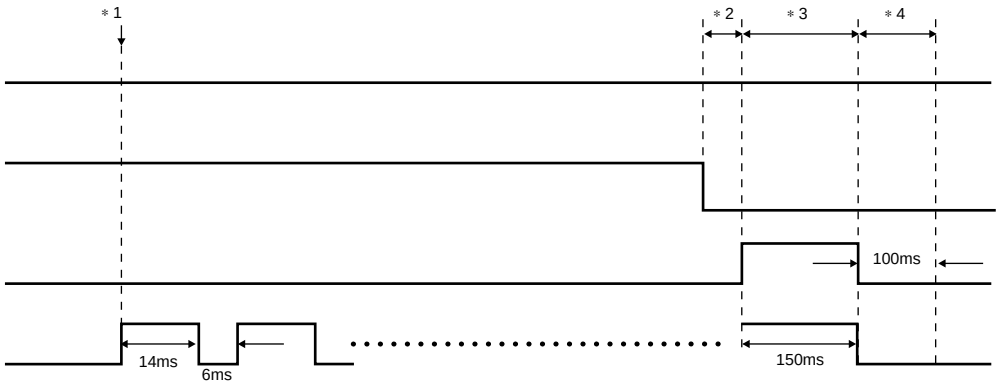
Condition of working	PICKMECHA movement to reverse from the Tray 2 to the Tray 1 side
Working Mode	PICKMECHA moves from the Tray 2 to the Tray 1 side➡External pressure placed on PICKMECHA➡PICKMECHA moves from the Tray 1 to the Tray 2 side



*1.Point of unloading to start
*2. Active point of SW2A
*3. Recognition time of SW2A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Mechanic action over time (6 seconds)
*6. Short break time for loading motor

TRAYMECHA Timing Chart (15)

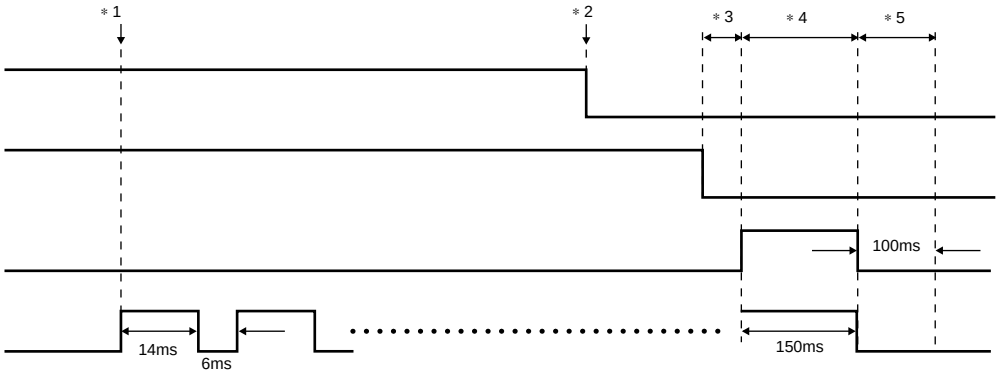
Condition of working	Tray Initial (Mode 1) MECHASW = “H”, SW1A = “H”
Working Mode	Tray 2 open or opening ➡ Power turned on ➡ Tray 2 close



*1.Point of turning on the power (Point of loading start)
*2.Recognition time of SW1A”L”
*3.Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW1A turns to “H” during this time, forward pulse drive is operated. When SW1A turns to “L” again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*4. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (16)

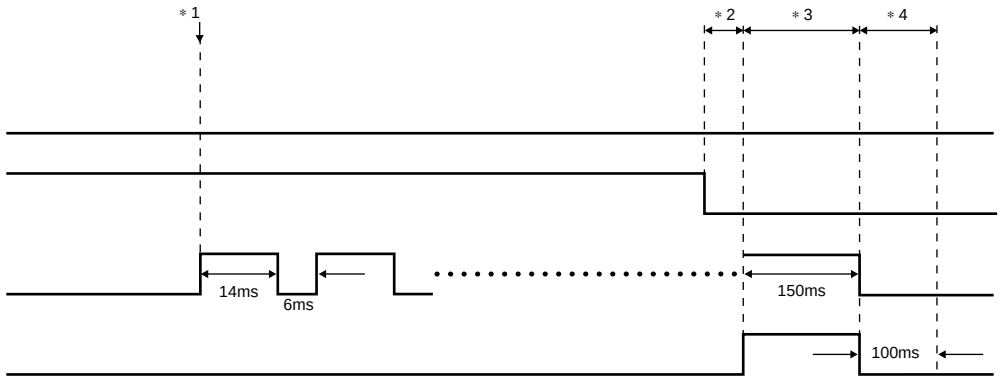
Condition of working	Tray Initial (Mode 2) MECHASW = “H”, SW2A = “H”
Working Mode	PICKMECHA moving ➡ Power turned on ➡ PICKMECHA moves from the Tray 1 to the Tray 2 side



*1. Point of turning on the power (Point of PICKMECHA to start moving)
*2. Active point of MECHASW
*3. Recognition time of SW2A”L”
*4. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW2A turns to “H” during this time, forward pulse drive is operated. When SW2A turns to “L” again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*5. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (17)

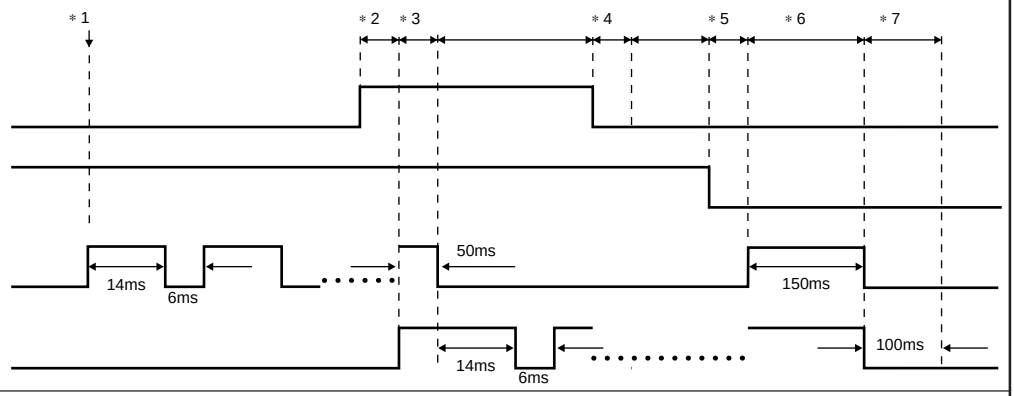
Condition of working	Tray Initial (Mode 3) MECHASW = “L”, SW2A = “H”
Working Mode	Tray 1 open or opening ➡ Power turned on ➡ Tray 1 close



*1. Point of turning on the power (Point of loading start)
*2.Recognition time of SW2A”L”
*3. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW2A turns to “H” during this time, reverse pulse drive is operated. When SW2A turns to “L” again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*4. Waiting time before moving to the next mode.

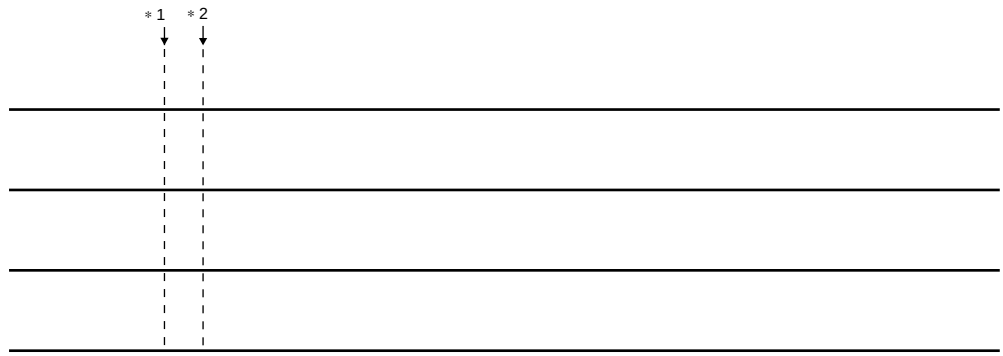
TRAYMECHA Timing Chart (18)

Condition of working	Tray Initial (Mode 4) MECHASW = “L”, SW2A = “H”
Working Mode	PICKMECHA moving ➡ Power turned on ➡ PICKMECHA moves from the Tray 2 to the Tray 1 side to detect MECHASW “H”



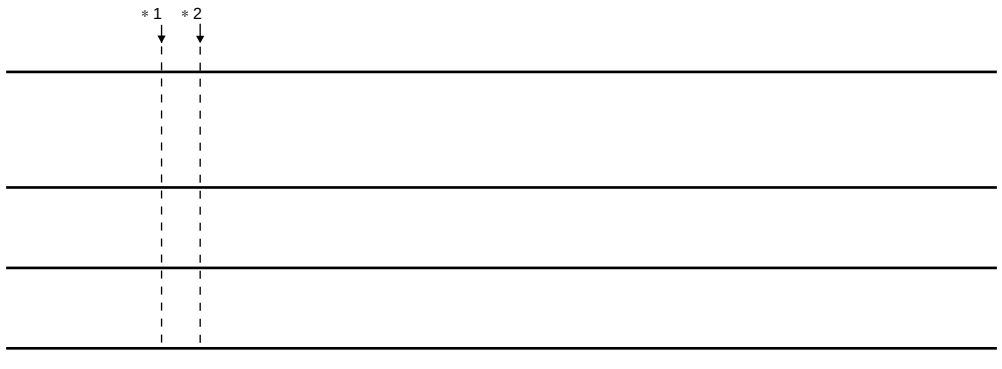
*1. Point of turning on the power (Point of PICKMECHA to start moving)
*2. Recognition of MECHASW “H”
*3. Short break time for loading motor
*4. Recognition of MECHASW “L”
*5. Recognition time of SW2A”L”
*6. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW2A turns to “H” during this time, forward pulse drive is operated. When SW2A turns to “L” again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*7. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (19)

Condition of working	Tray Initial (Mode 5) MECHASW = “L”, SW2A = “L”
Working Mode	Both trays close and MECHAPICK goes to the Tray 2 side ➡ Power on
	
MECHASW	
SW2A	
LOAD (+)	
LOAD (–)	

*1. Point of turning on the power
*2. Point of operation finish

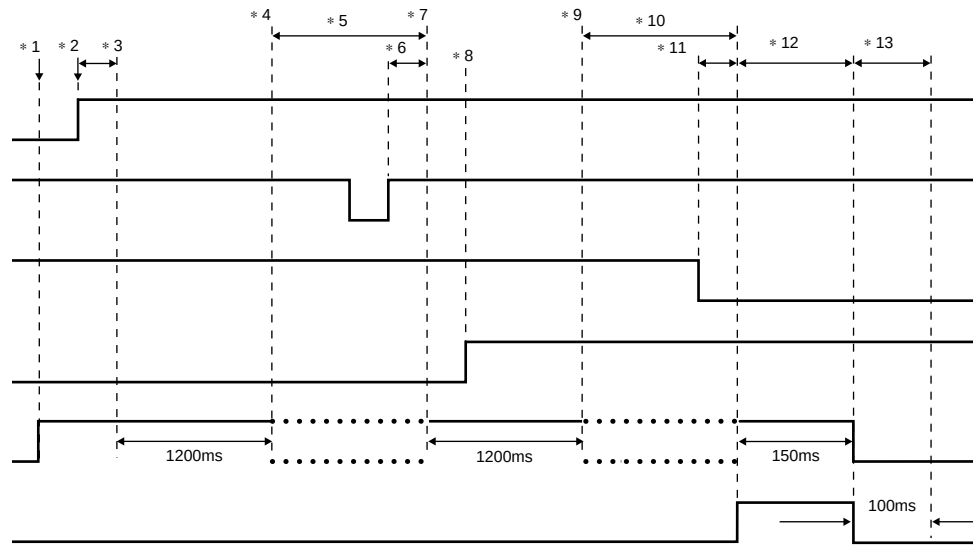
TRAYMECHA Timing Chart (20)

Condition of working	Tray Initial (Mode 6) MECHASW = “H”, SW1A = “L”
Working Mode	Both trays close and MECHAPICK goes to the Tray 1 side ➡ Power on
	
MECHASW	
SW1A	
LOAD (+)	
LOAD (–)	

*1. Point of turning on the power
*2. Point of operation finish

TRAYMECHA Timing Chart (21)

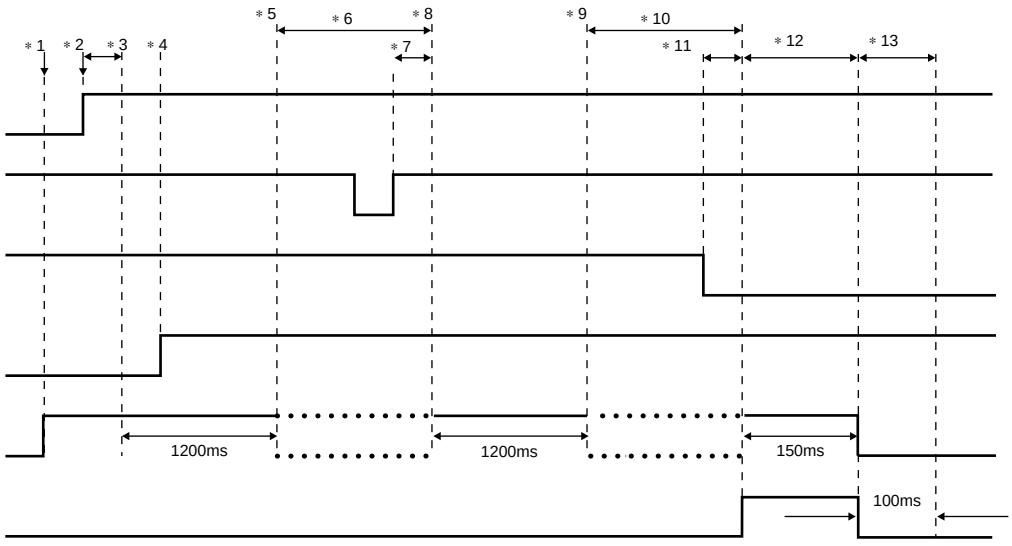
Condition of working	While Tray 1 is open, MECHAPICK moves from the Tray 2 to the Tray 1
Working Mode	Tray 1 open ➡ Tray 1 closed ➡ ➡ MECHAPICK moves from the Tray 2 to the Tray 1 side



*1. Point of loading to start with key operation
*2. Active point of SW2B
*3. Recognition time of SW2B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Pulse driving (low-speed mode) time
*6. Recognition time of SW2A switching from "L" to "H"
*7. Switching point from low-speed to high-speed mode
*8. Active point of MECHASW
*9. Switching point from high-speed mode to low-speed mode.
*10. Pulse driving (low-speed mode) time
*11. Recognition time of SW1A"L"
*12. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW1A turns to "H" during this time, reverse pulse drive is operated. When SW1A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*13. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (22)

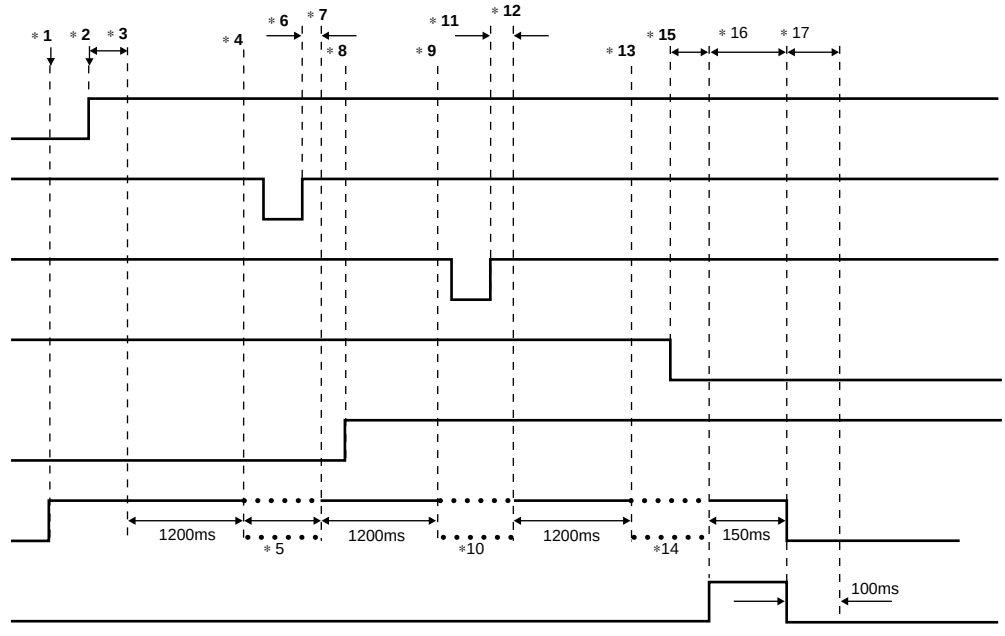
Condition of working	From the position of Tray 1 Closed to the time for Tray 2 to be discharged
Working Mode	Tray 1 closed ➡MECHAPICK moves from the Tray 2 to the Tray 1 side ➡Tray 2 open



*1. Point of loading to start with key operation
*2. Active point of SW2A
*3. Recognition time of SW2A"H"
*4. Active point of MECHASW
*5. Switching point from high-speed mode to low-speed mode.
*6. Pulse driving (low-speed mode) time
*7. Recognition time of SW1A switching from "L" to "H"
*8. Switching point from low-speed to high-speed mode
*9. Switching point from high-speed mode to low-speed mode.
*10. Pulse driving (low-speed mode) time
*11. Recognition time of SW1B"L"
*12. Short break time for loading motor
*13. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (23)

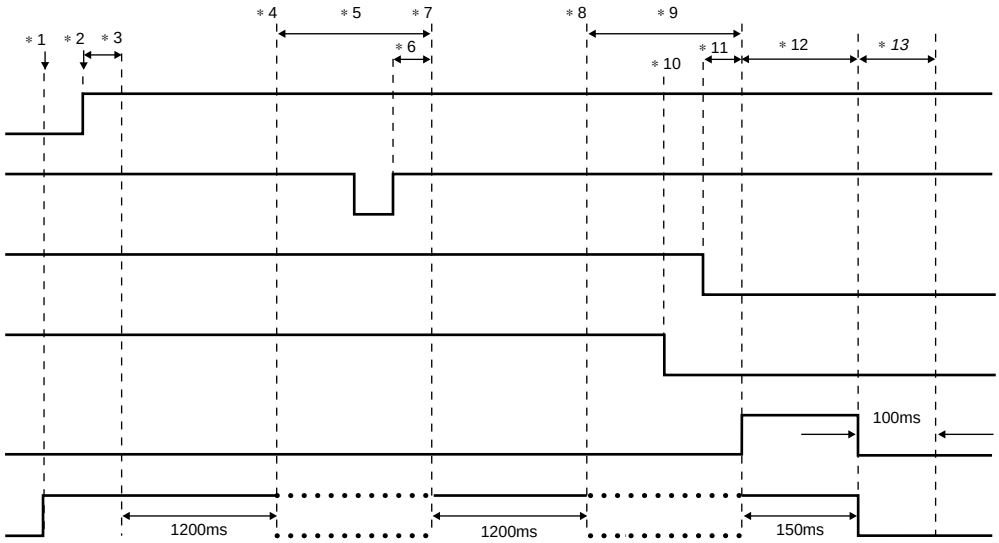
Condition of working	From the position of Tray 1 Open to the time of Tray 2 to be discharged
Working Mode	Tray 1 open ➡Tray 1 closed ➡MECHAPICK moves from the Tray 2 to the Tray 1 side ➡Tray 2 open



*1. Point of loading to start with key operation
*2. Active point of SW2B
*3. Recognition time of SW2B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Pulse driving (low-speed mode) time
*6. Recognition time of SW2A switching from "L" to "H"
*7. Switching point from low-speed to high-speed mode
*8. Active point of MECHASW
*9. Switching point from high-speed mode to low-speed mode.
*10. Pulse driving (low-speed mode) time
*11. Recognition time of SW1A switching from "L" to "H"
*12. Switching point from low-speed to high-speed mode
*13. Switching point from high-speed mode to low-speed mode.
*14. Pulse driving (low-speed mode) time
*15. Recognition time of SW1B"L"
*16. Short break time for loading motor
*17. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (24)

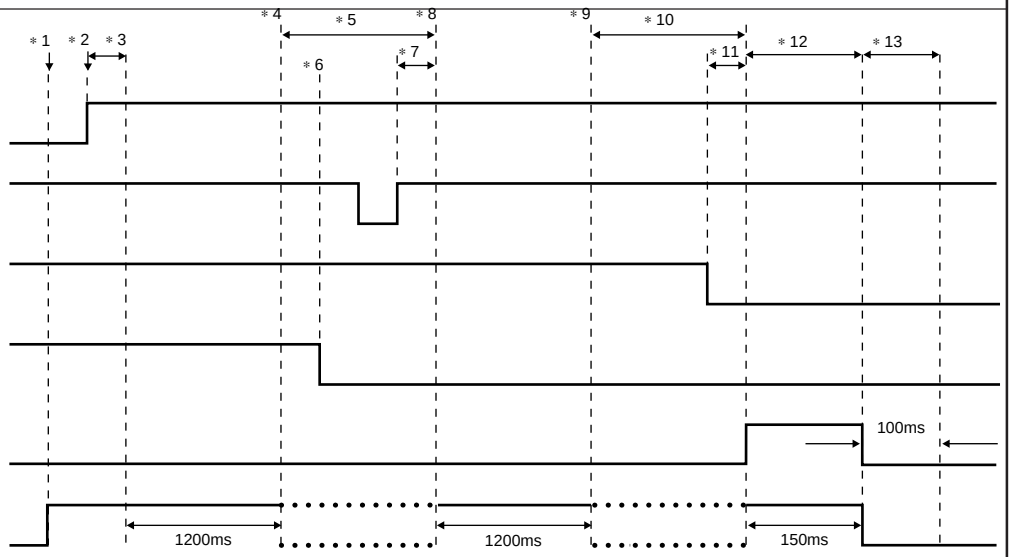
Condition of working	While Tray 2 is open and MECHAPICK moves from the Tray 1 to the Tray 2 side
Working Mode	Tray 2 open ➡Tray 2 closed ➡MECHAPICK moves from the Tray 1 to the Tray 2 side



*1. Point of loading to start with key operation
*2. Active point of SW1B
*3. Recognition time of SW1B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Pulse driving (low-speed mode) time
*6. Recognition time of SW1A switching from "L" to "H"
*7. Switching point from low-speed to high-speed mode
*8. Switching point from high-speed mode to low-speed mode.
*9. Pulse driving (low-speed mode) time
*10. Active point of MECHASW
*11. Recognition time of SW2A"L"
*12. Short break time for loading motor (During this time, 100mS period after 50mS passes, overrun check for motor stop position is performed. If SW2A turns to "H" during this time, forward pulse drive is operated. When SW2A turns to "L" again, it goes back to Break Mode. This action will be repeated a maximum of 3 times.)
*13. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (25)

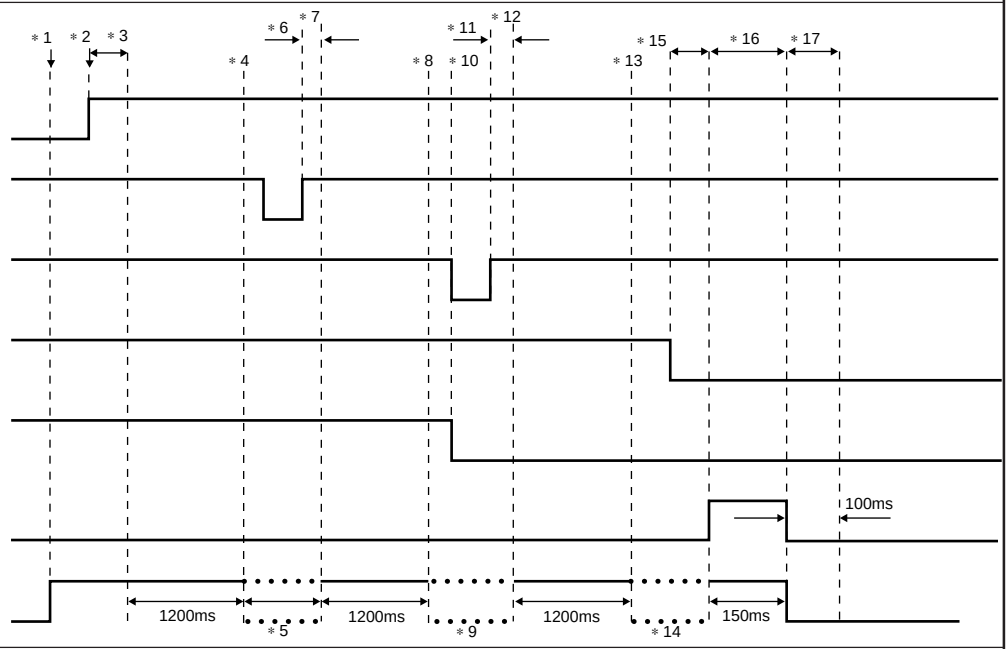
Condition of working	From the position of Tray 2 Closed to the time for Tray 1 to be discharged
Working Mode	Tray 2 closed ➡ MECHAPICK moves from the Tray 1 to the Tray 2 side ➡Tray 1 open



*1. Point of loading to start with key operation
*2. Active point of SW1A
*3. Recognition time of SW1A"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Pulse driving (low-speed mode) time
*6. Active point of MECHASW
*7. Recognition time of SW2A switching from "L" to "H"
*8. Switching point from low-speed to high-speed mode
*9. Switching point from high-speed mode to low-speed mode.
*10. Pulse driving (low-speed mode) time
*11. Recognition time of SW2B"L"
*12. Short break time for loading motor
*13. Waiting time before moving to the next mode.

TRAYMECHA Timing Chart (26)

Condition of working	From the position of Tray 2 Open to the time of Tray 1 to be discharged
Working Mode	Tray 2 open ➡Tray 2 closed ➡MECHAPICK moves from the Tray 1 to the Tray 2 side ➡Tray 1 open



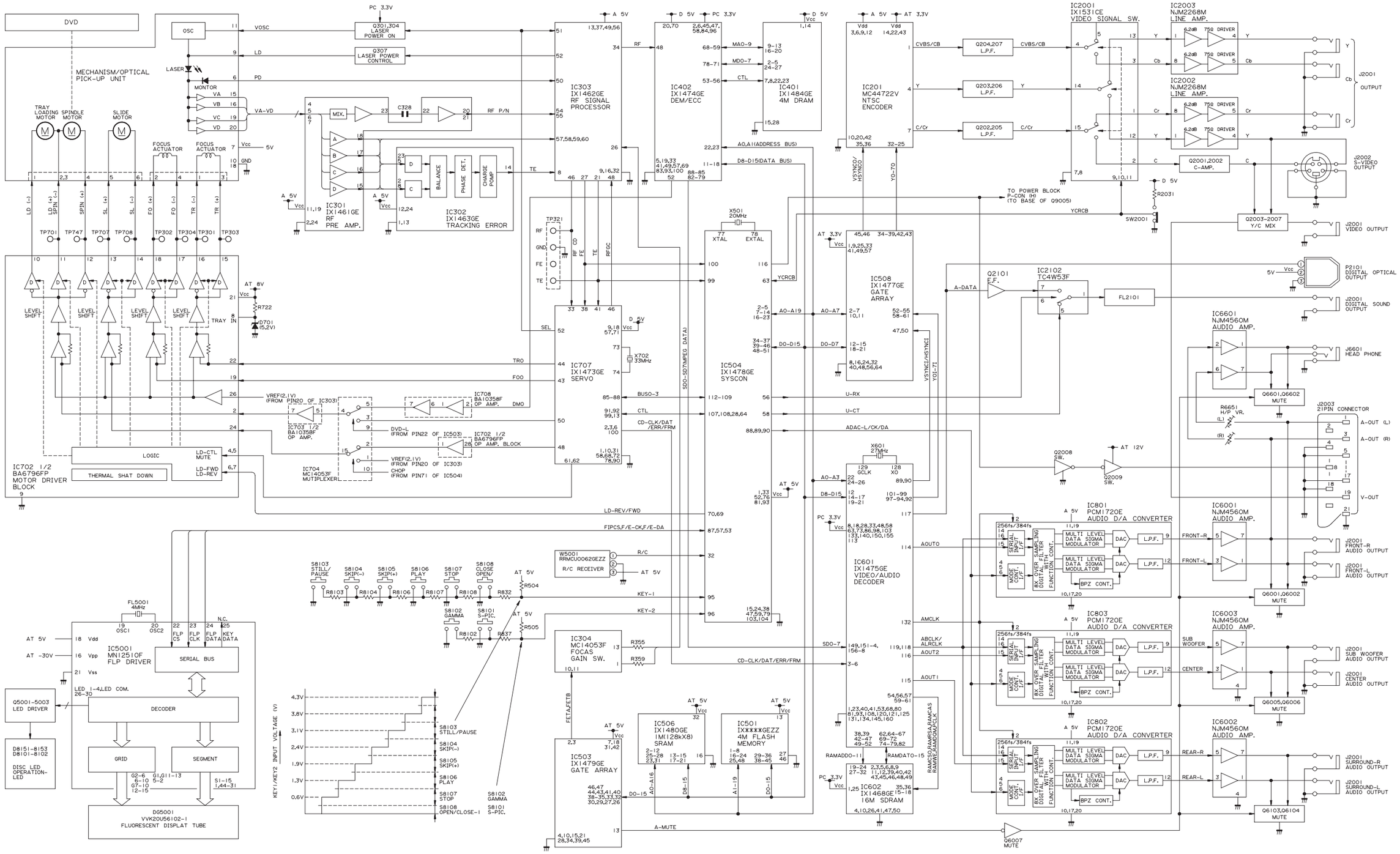
*1. Point of loading to start with key operation
*2. Active point of SW1B
*3. Recognition time of SW1B"H"
*4. Switching point from high-speed mode to low-speed mode.
*5. Pulse driving (low-speed mode) time
*6. Recognition time of SW1A switching from "L" to "H"
*7. Switching point from low-speed to high-speed mode
*8. Switching point from high-speed mode to low-speed mode.
*9. Pulse driving (low-speed mode) time
*10. Active point of MECHASW
*11. Recognition time of SW2A switching from "L" to "H"
*12. Switching point from low-speed to high-speed mode
*13. Switching point from high-speed mode to low-speed mode.
*14. Pulse driving (low-speed mode) time
*15. Recognition time of SW2B"L"
*16. Short break time for loading motor
*17. Waiting time before moving to the next mode.

DVD-Series

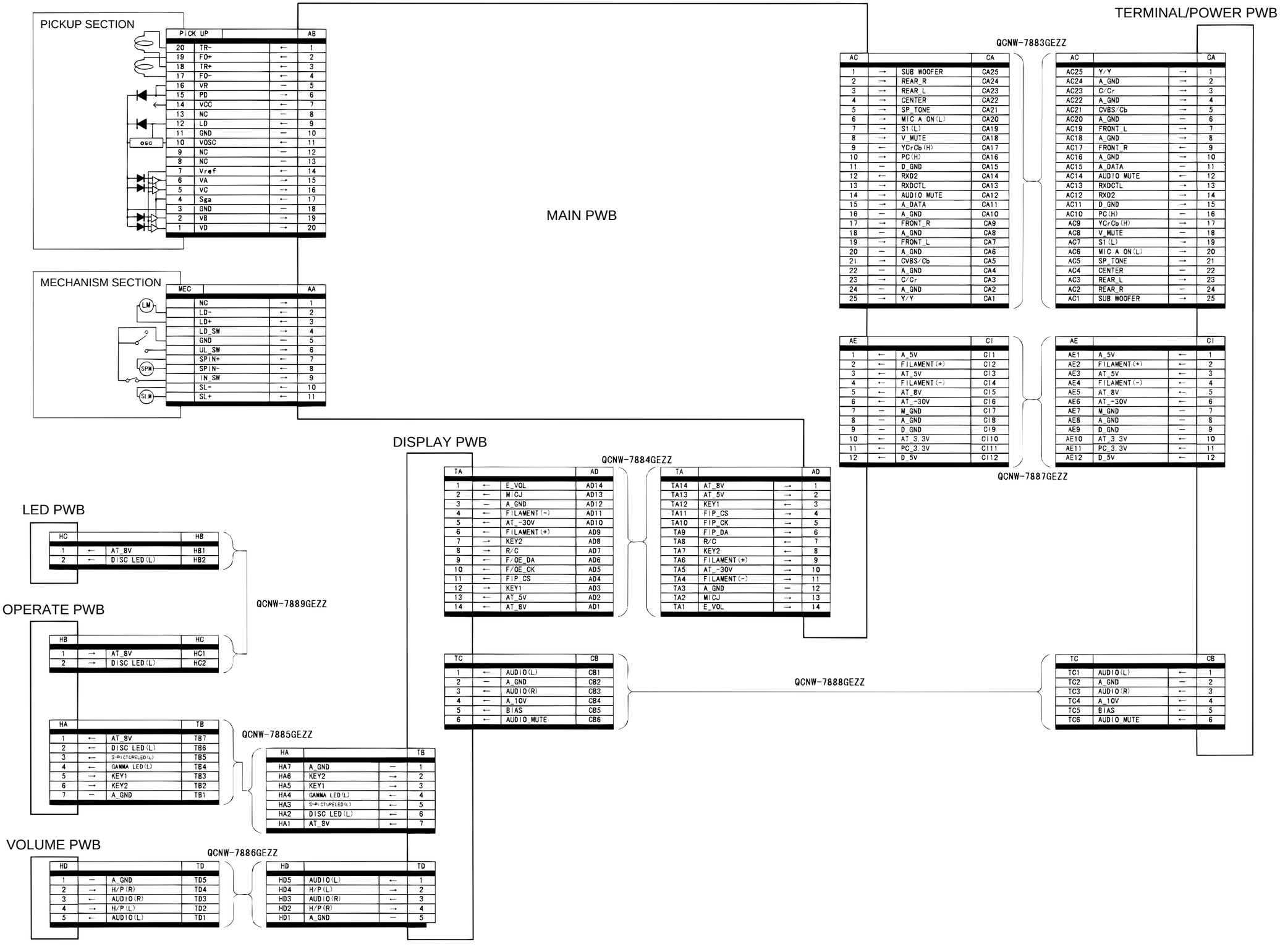
SHARP

Printed in JAPAN

14. BLOCK DIAGRAM

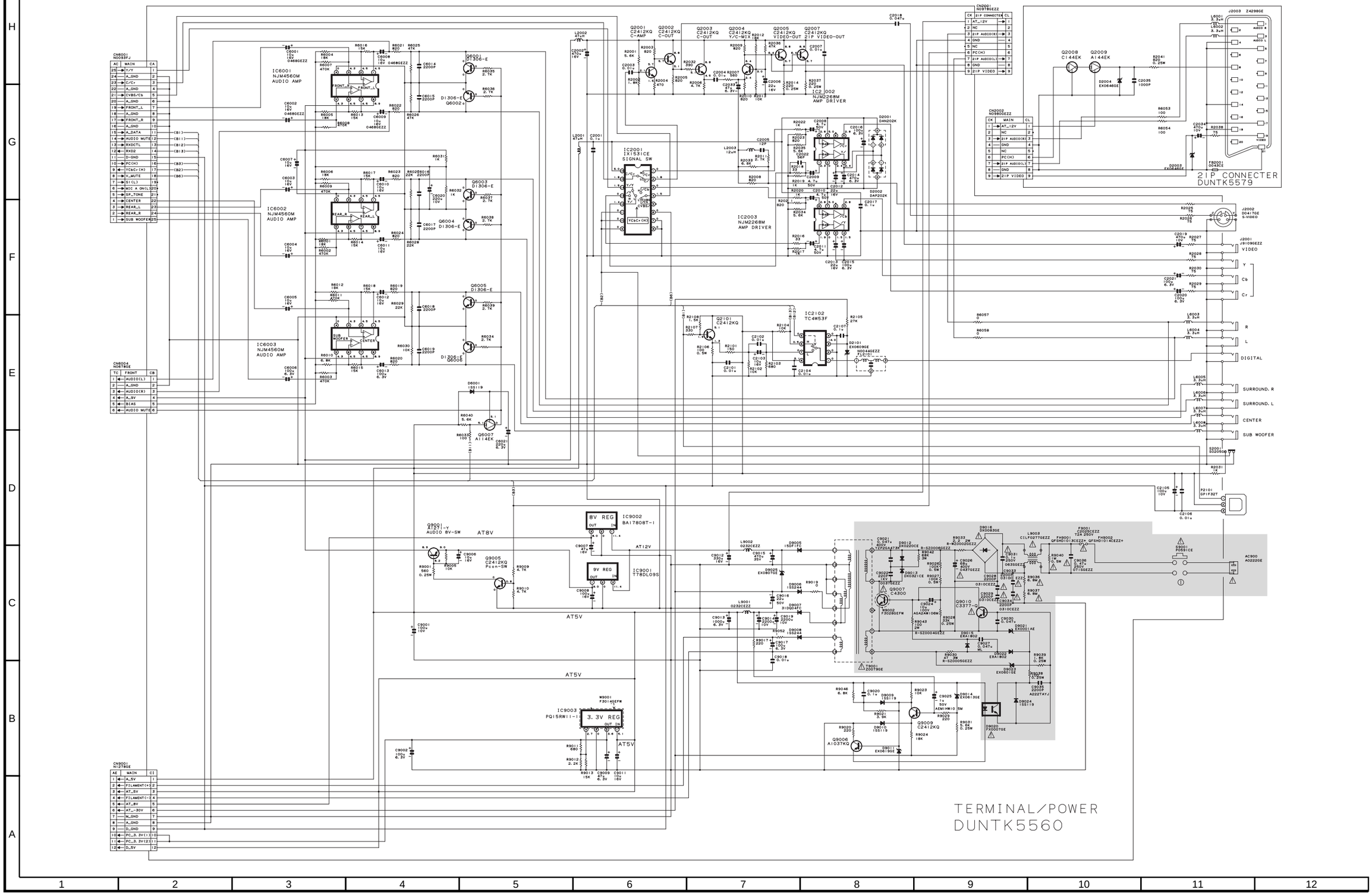


15. WIRING DIAGRAM

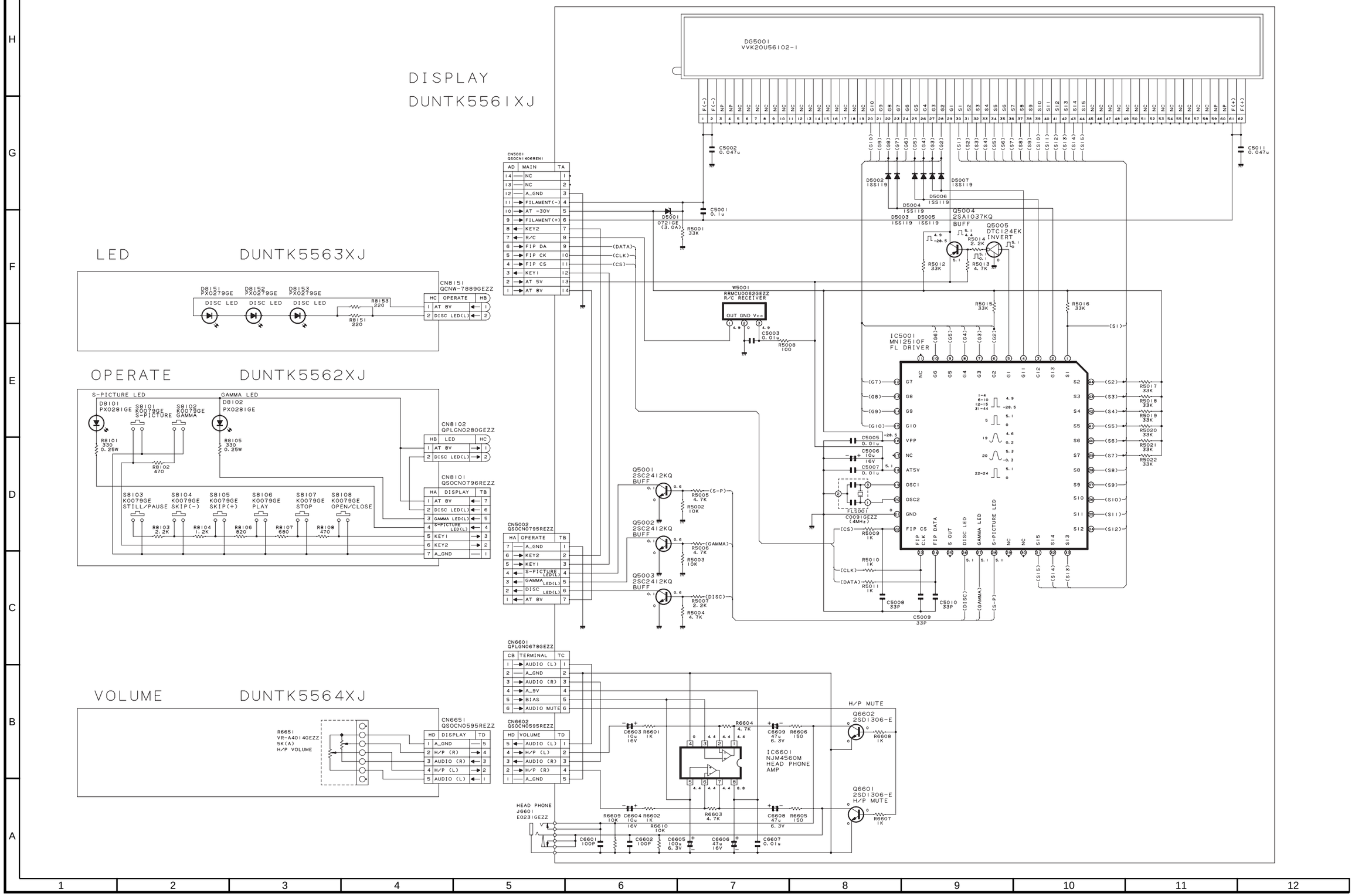


16-3. TERMINAL/POWER/21-PIN EURO-SCART CIRCUIT SCHEMATIC DIAGRAM

⚠ AND SHADED COMPONENTS=SAFETY RELATED PARTS



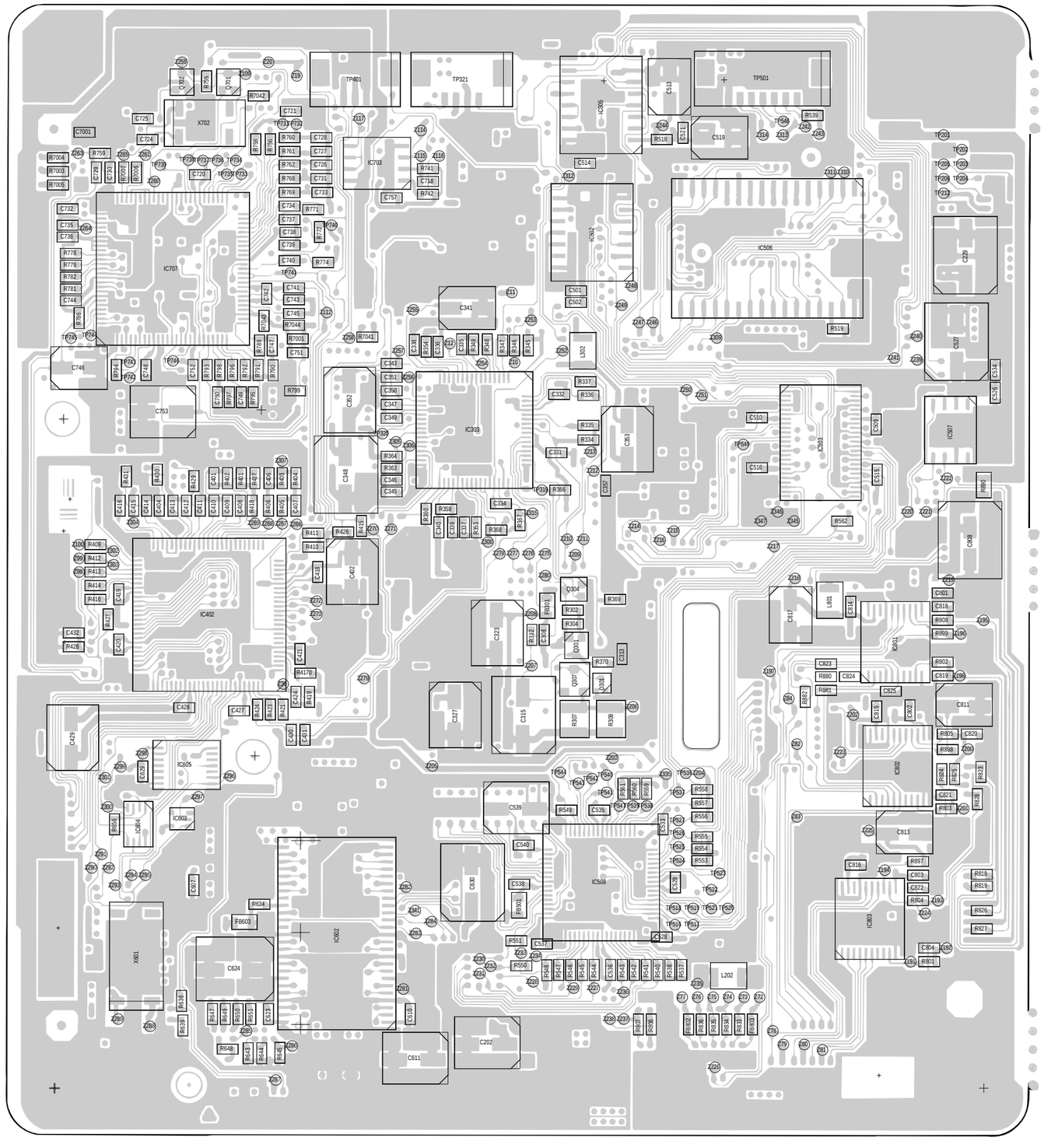
16-4. DISPLAY/LED/OPERATE/VOLUME CIRCUIT SCHEMATIC DIAGRAM



17. PRINTED WIRING BOARD ASSEMBLIES

17-1. MAIN P.W.B.

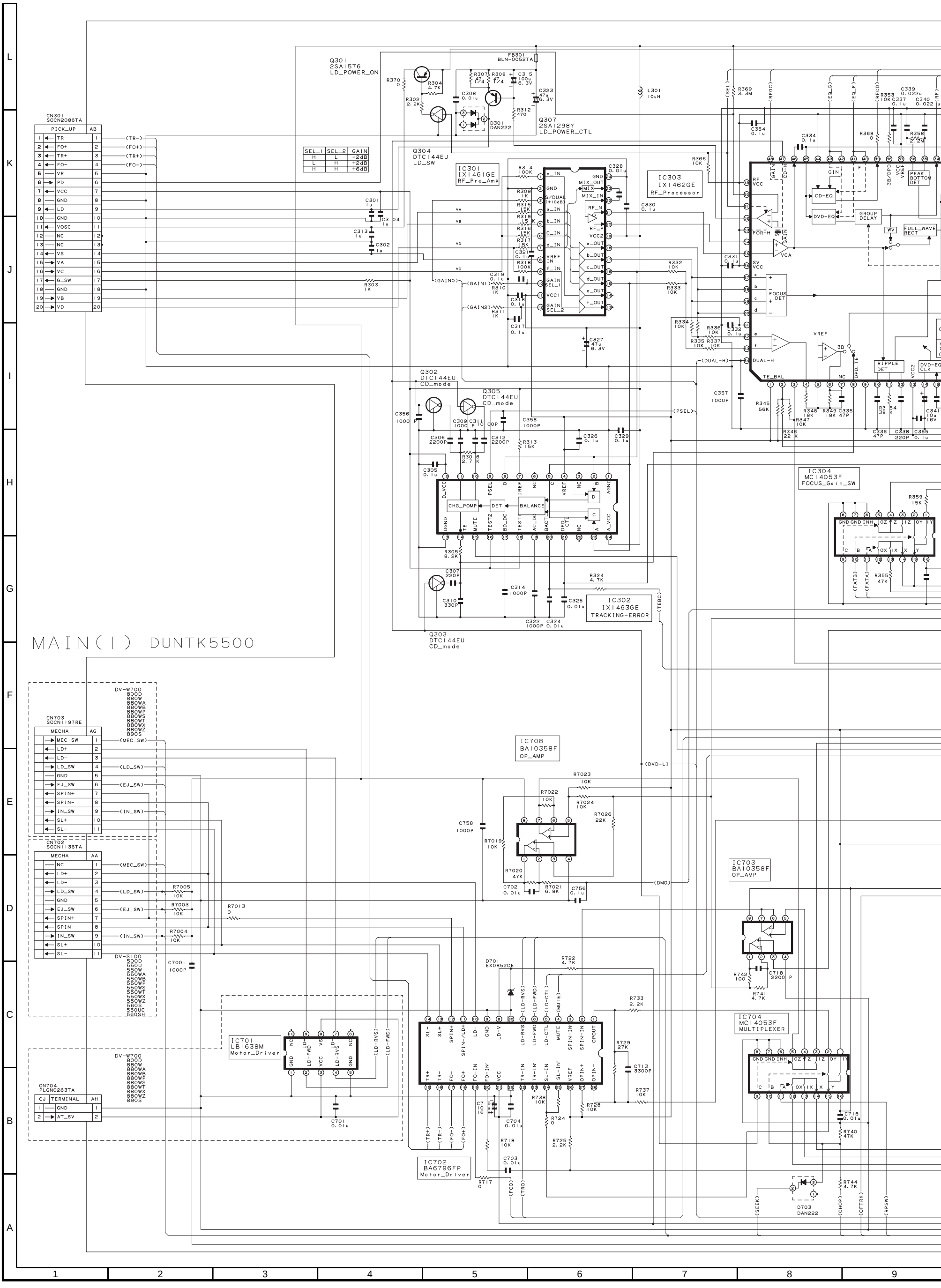
Componet Side

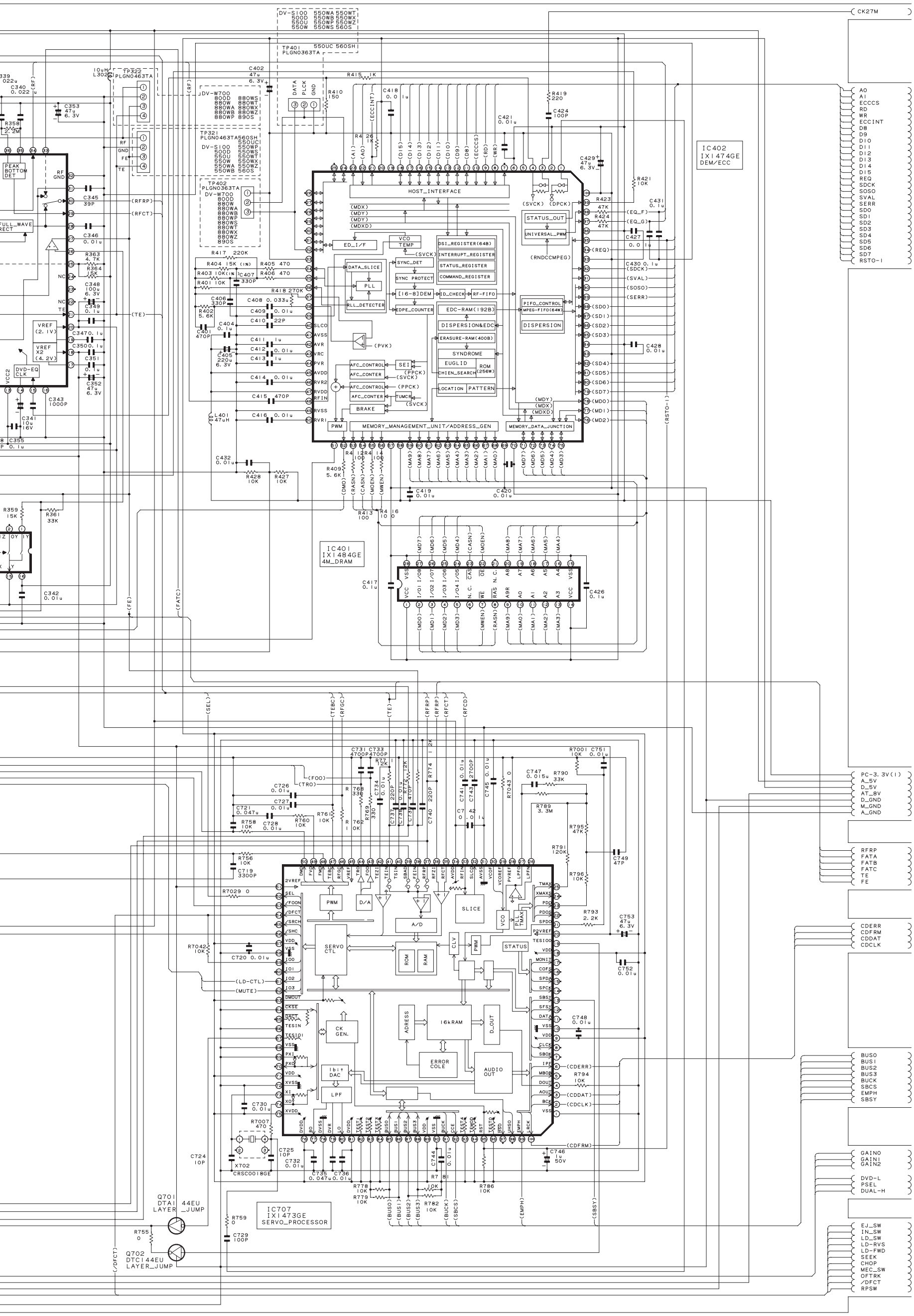


17-1 17-2

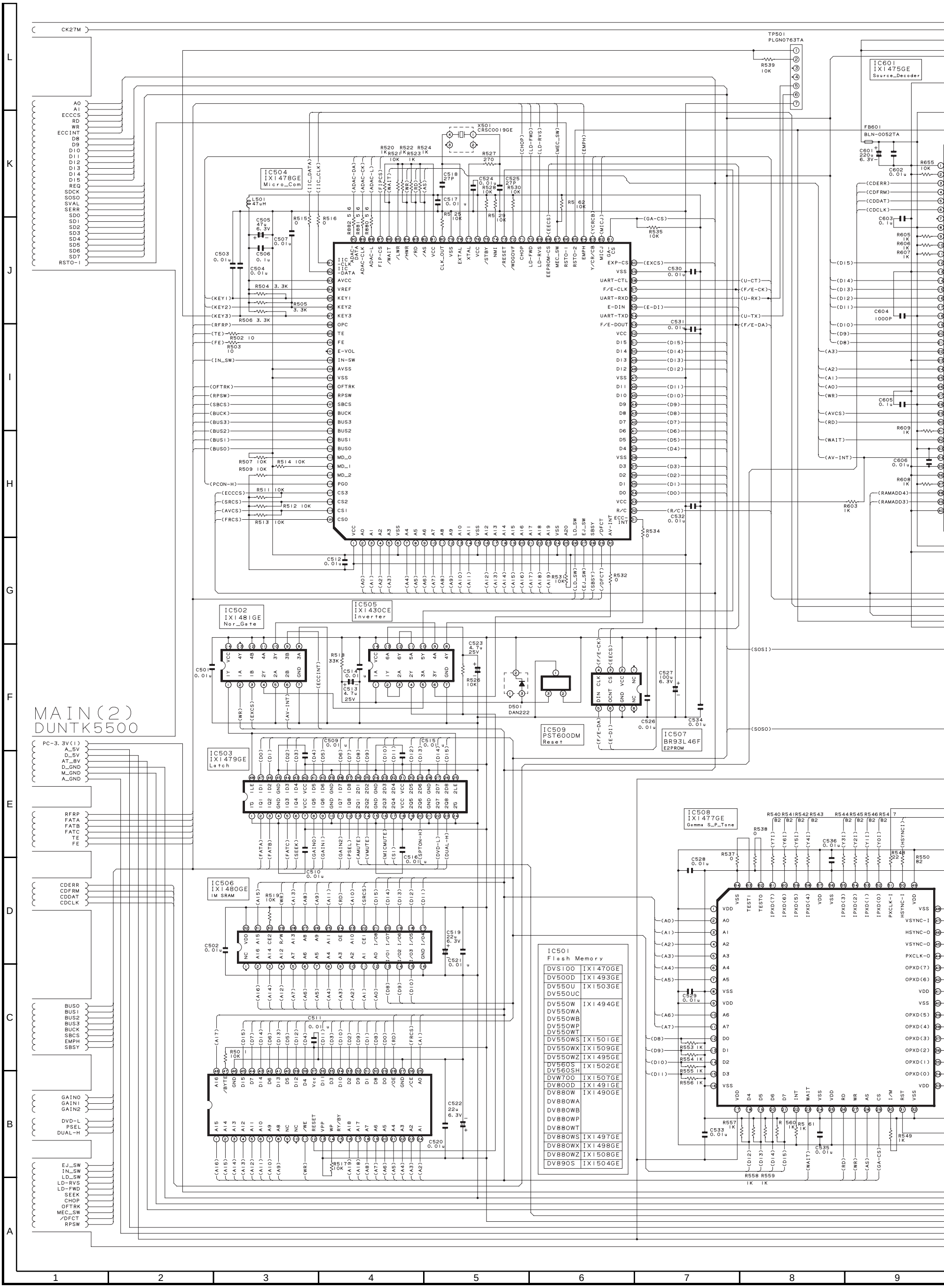
16. SCHEMATIC DIAGRAM

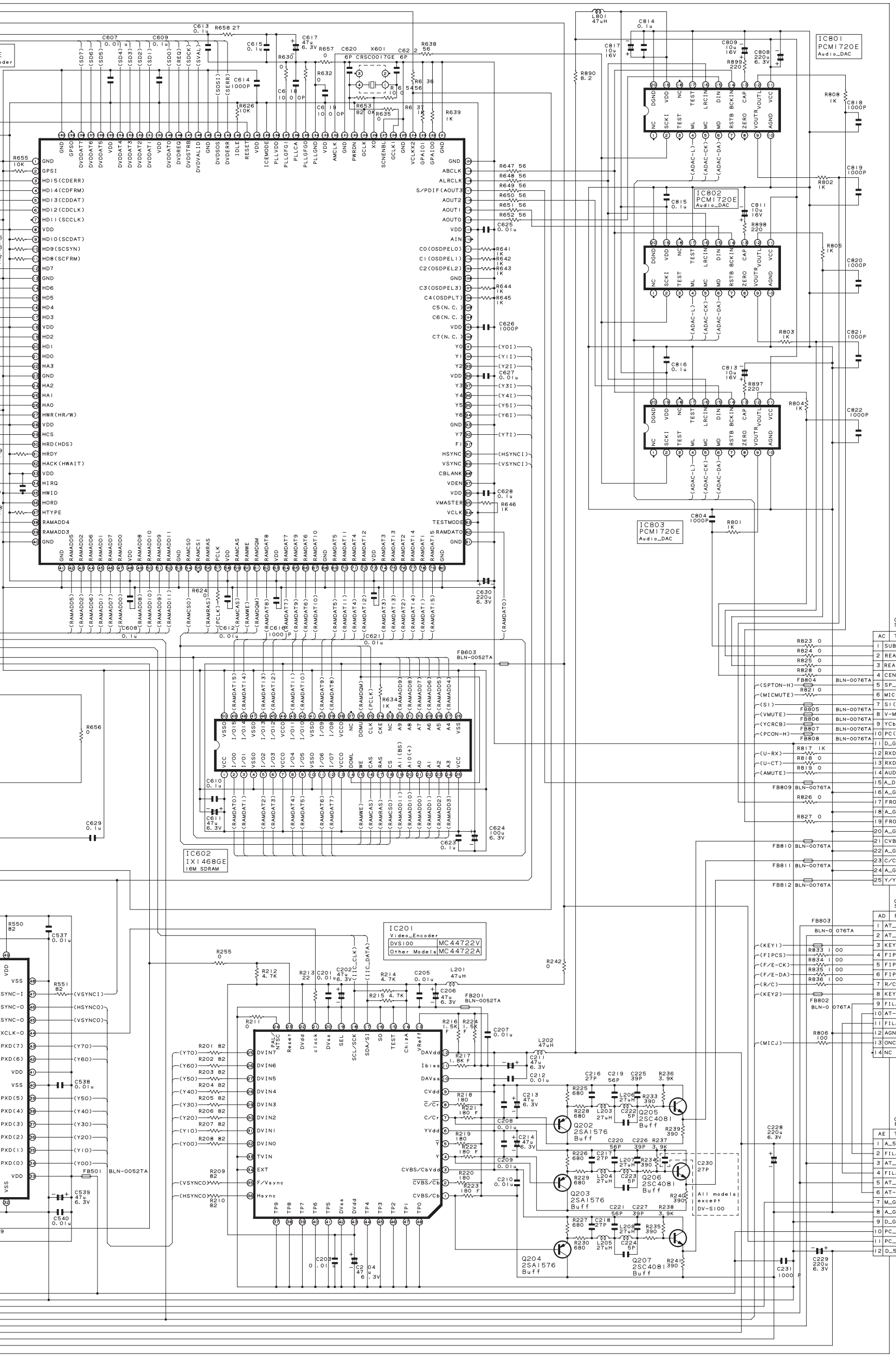
16-1. MAIN CIRCUIT SCHEMATIC DIAGRAM (1/2)



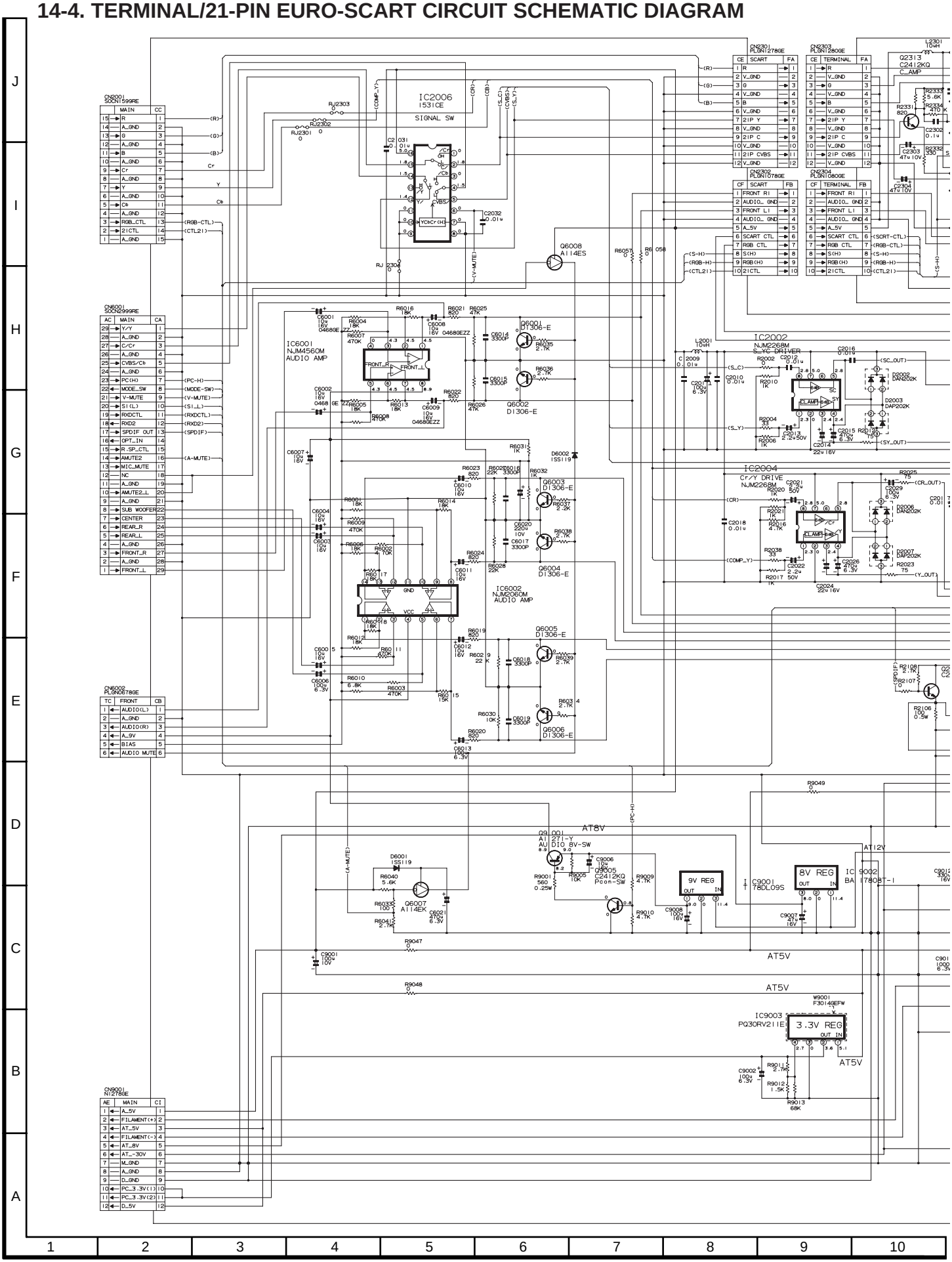

IC402
IX1474GE
DEM/ECC
IC401
IX1484GE
4M_DRAM
IC707
IX1473GE
SERVO_PROCESSOR
HOST_INTERFACE
MEMORY_MANAGEMENT_UNIT/ADDRESS_GEN
MEMORY_DATA_JUNCTION
ED_I/F
DATA_SLICE
PLL
PLL_DETECTER
SYNC_DET
SYNC PROTECT
[16-8]DEM
EDPE_COUNTER
ID_CHECK
RF-FIFO
EDC-RAM(192B)
DISPERSION&EDC
ERASURE-RAM(400B)
SYNDROME
EUGLID
CHIEN_SEARCH
ROM (256W)
LOCATION
PATTERN
DISPERSION
PIFO_CONTROL
MPEG-FIFO(64W)
DSI_REGISTER(64B)
INTERRUPT_REGISTER
STATUS_REGISTER
COMMAND_REGISTER
STATUS_OUT
UNIVERSAL_PWM
AFC_CONTROL
AFC_CONTER
SEI
BRAKE
PWM
D/A
A/D
SLICE
SERVO CTL
ROM
RAM
CLV
PWM
STATUS
VCO
PLL TMAX
CK GEN.
ADRESS
16kRAM
D_OUT
ERROR COLE
AUDIO OUT
1bit DAC
LPF
CK27M
A0
A1
ECCCS
RD
WR
ECCINT
D8
D9
D10
D11
D12
D13
D14
D15
REQ
SDCK
SDSO
SVAL
SERR
SDO
SDI
SD2
SD3
SD4
SD5
SD6
SD7
RSTO-I
PC-3.3V(1)
A_5V
D_5V
AT_8V
D_GND
M_GND
A_GND
RFRP
FATA
FATB
FATC
TE
FE
CDERR
CDFRM
CDDAT
CDCLK
BUSO
BUS1
BUS2
BUS3
BUCK
SBCS
EMPH
SBSY
GAINO
GAIN1
GAIN2
DVD-L
PSEL
DUAL-H
EJ_SW
IN_SW
LD_SW
LD-RVS
LD-FWD
SEEK
CHOP
MEC_SW
OFTRK
/DFCT
RPSW
Q701 DTA144EU LAYER_JUMP
Q702 DTC144EU LAYER_JUMP
X702 CRSC0018GE
TP322 PLGN0463TA
TP321 PLGN0463TA
TP401 PLGN0363TA
TP402 PLGN0363TA
DV-S100 550WA 550WT 500D 550WB 550WX 550U 550WP 550WZ 550W 550WS 560S
DV-W700 800D 880WS 880W 880WT 880WA 880WX 880WB 880WZ 880WP 890S
DV-S100 550UC 560SH
DV-S100 550WP 500D 550WS 550U 550WT 550W 550WX 550WA 550WZ 550WB 560S
DV-W700 800D 880W 880WA 880WB 880WP 880WS 880WT 880WX 880WZ 890S

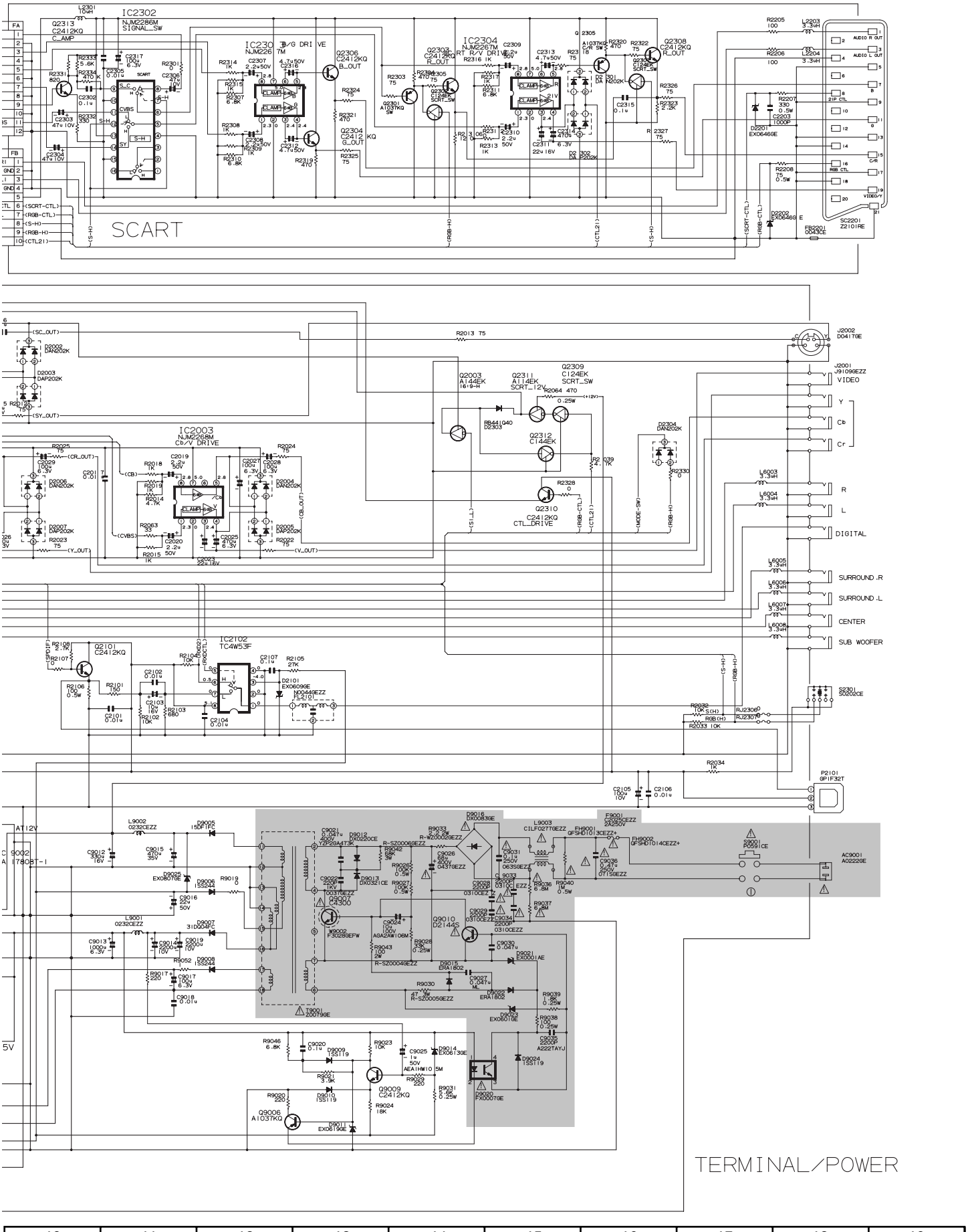
16-2. MAIN CIRCUIT SCHEMATIC DIAGRAM (2/2)




IC602
IX1468GE
16M SDRAM
IC201
Video_Encoder
DVS100 MC44722V
Other Models MC44722A
IC801
PCM1720E
Audio_DAC
IC802
PCM1720E
Audio_DAC
IC803
PCM1720E
Audio_DAC
CN801
SOCN2536TA
CN802
SOCN1497RE
CN201
PLGN1263TA
All models except DV-S100

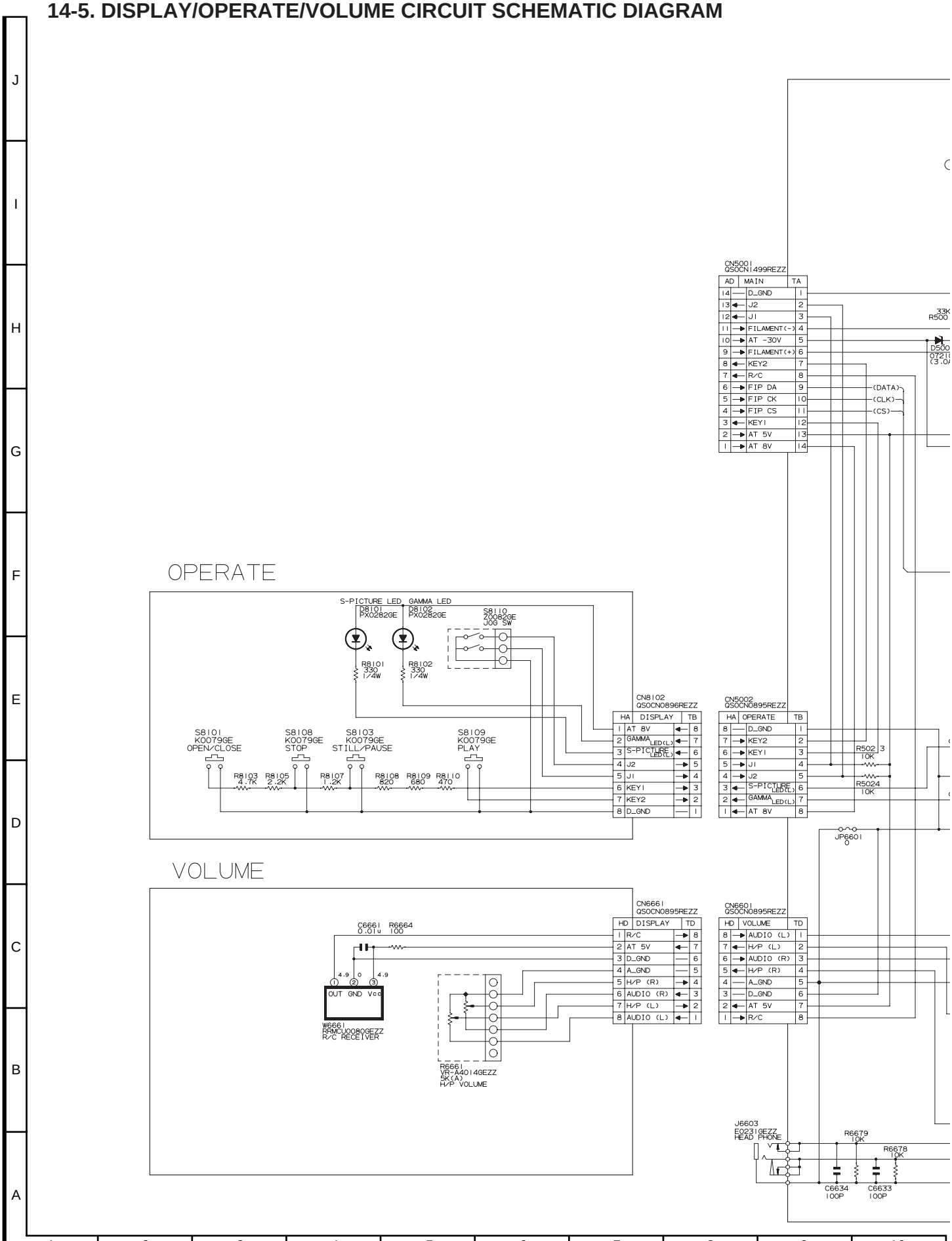
14-4. TERMINAL/21-PIN EURO-SCART CIRCUIT SCHEMATIC DIAGRAM

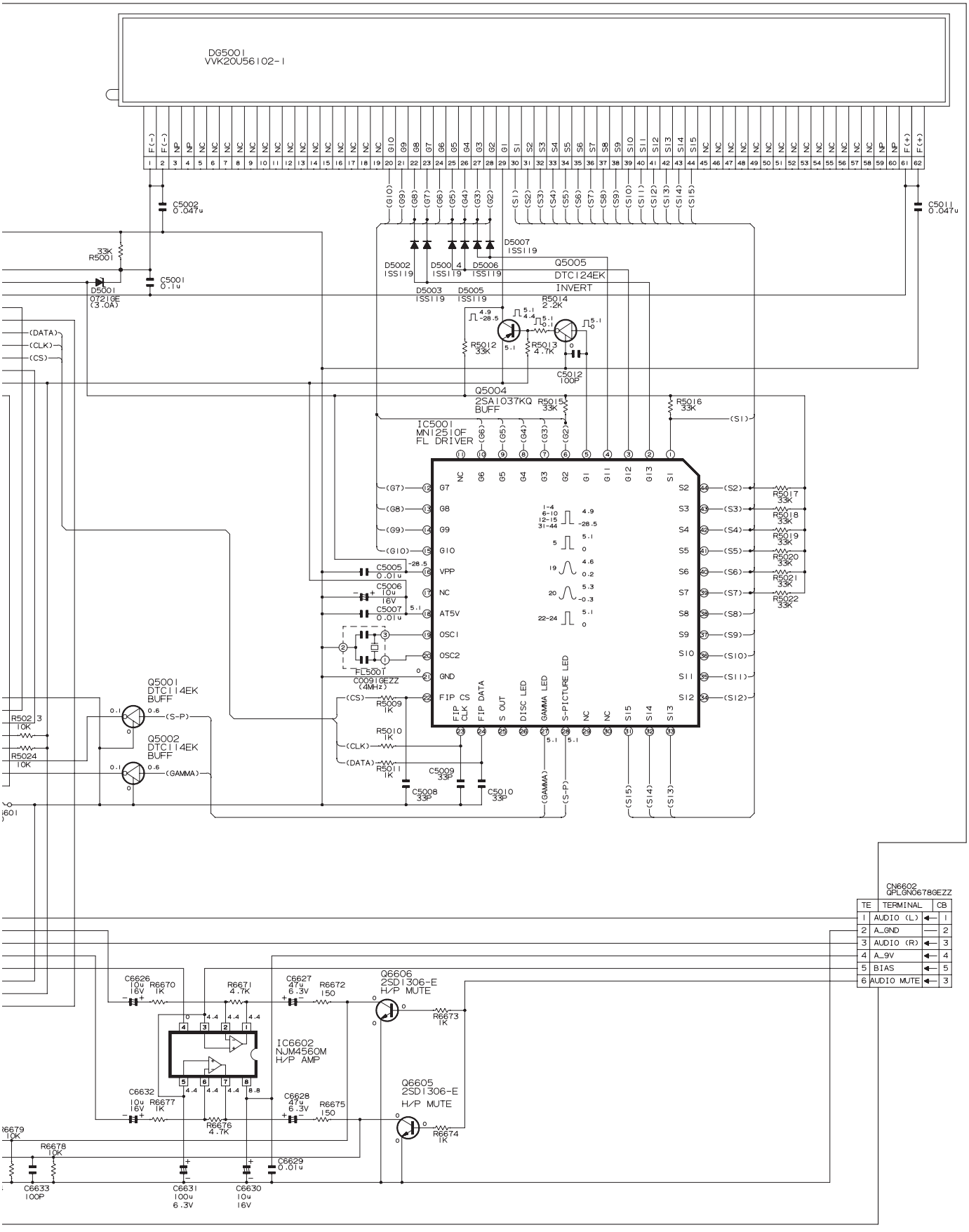




10	11	12	13	14	15	16	17	18	19

14-5. DISPLAY/OPERATE/VOLUME CIRCUIT SCHEMATIC DIAGRAM

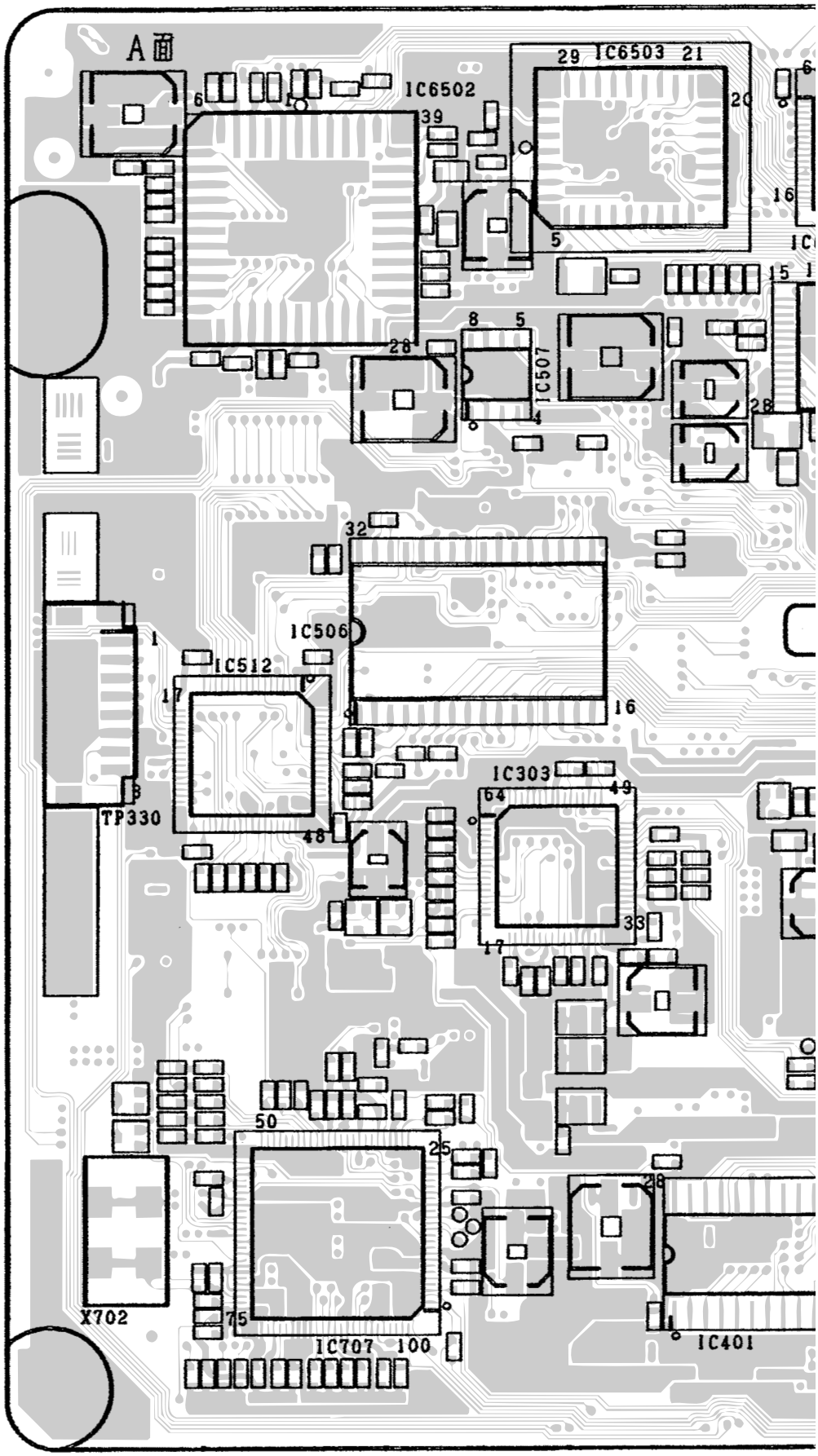


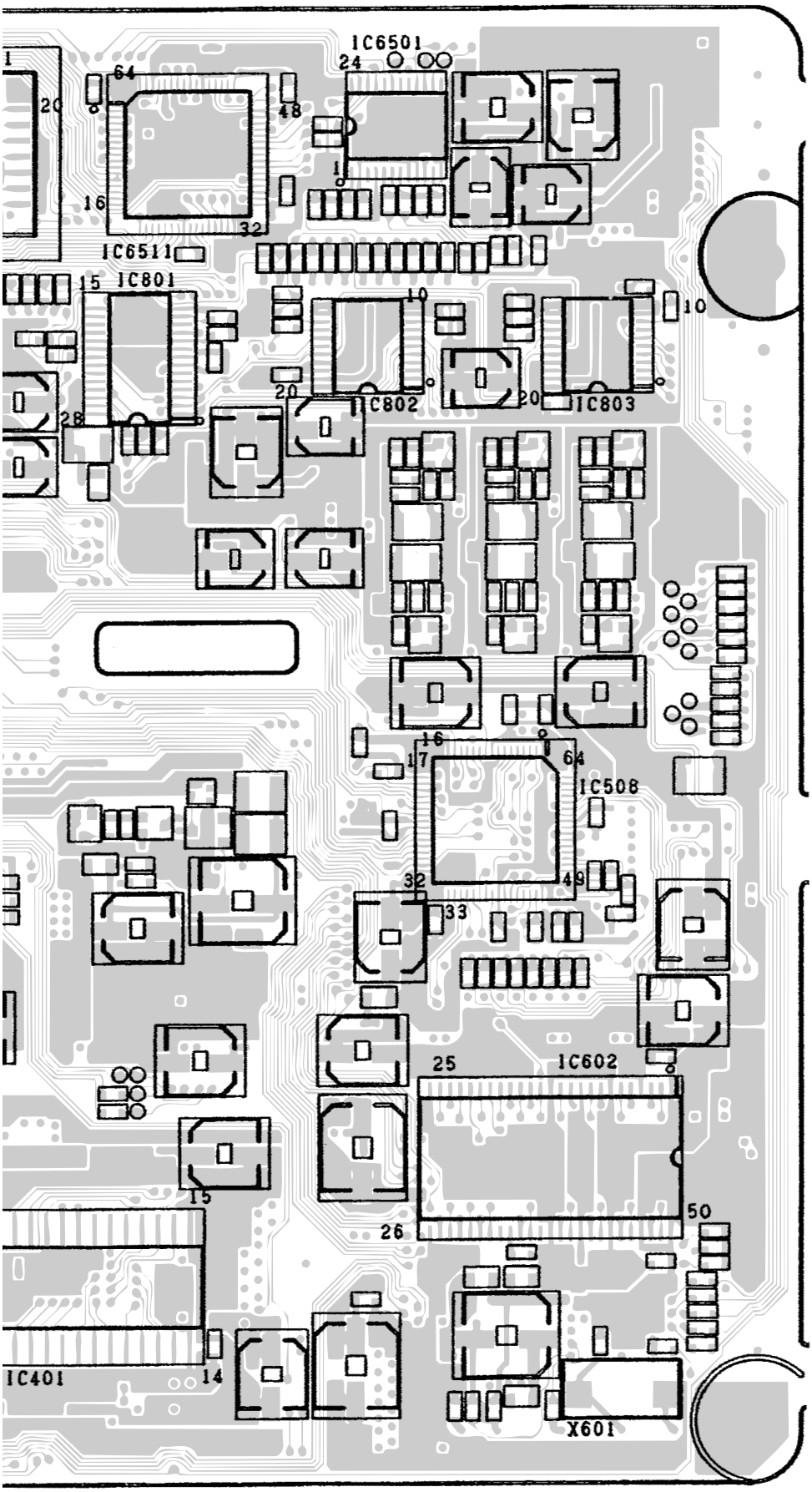


10	11	12	13	14	15	16	17	18	19

15. PRINTED WIRING BOARD ASSEMBLIES 15-1. MAIN P.W.B.

Componet Side

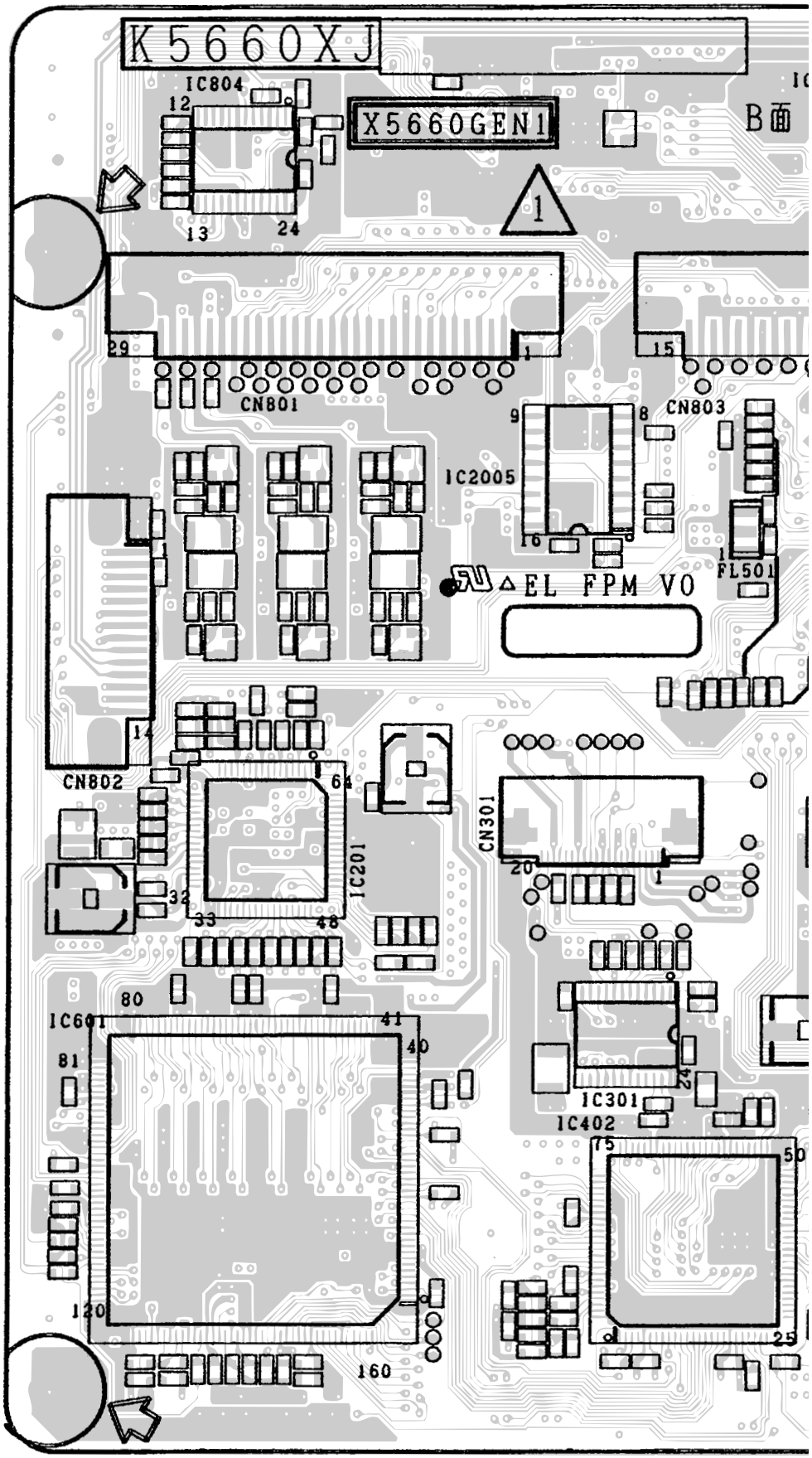


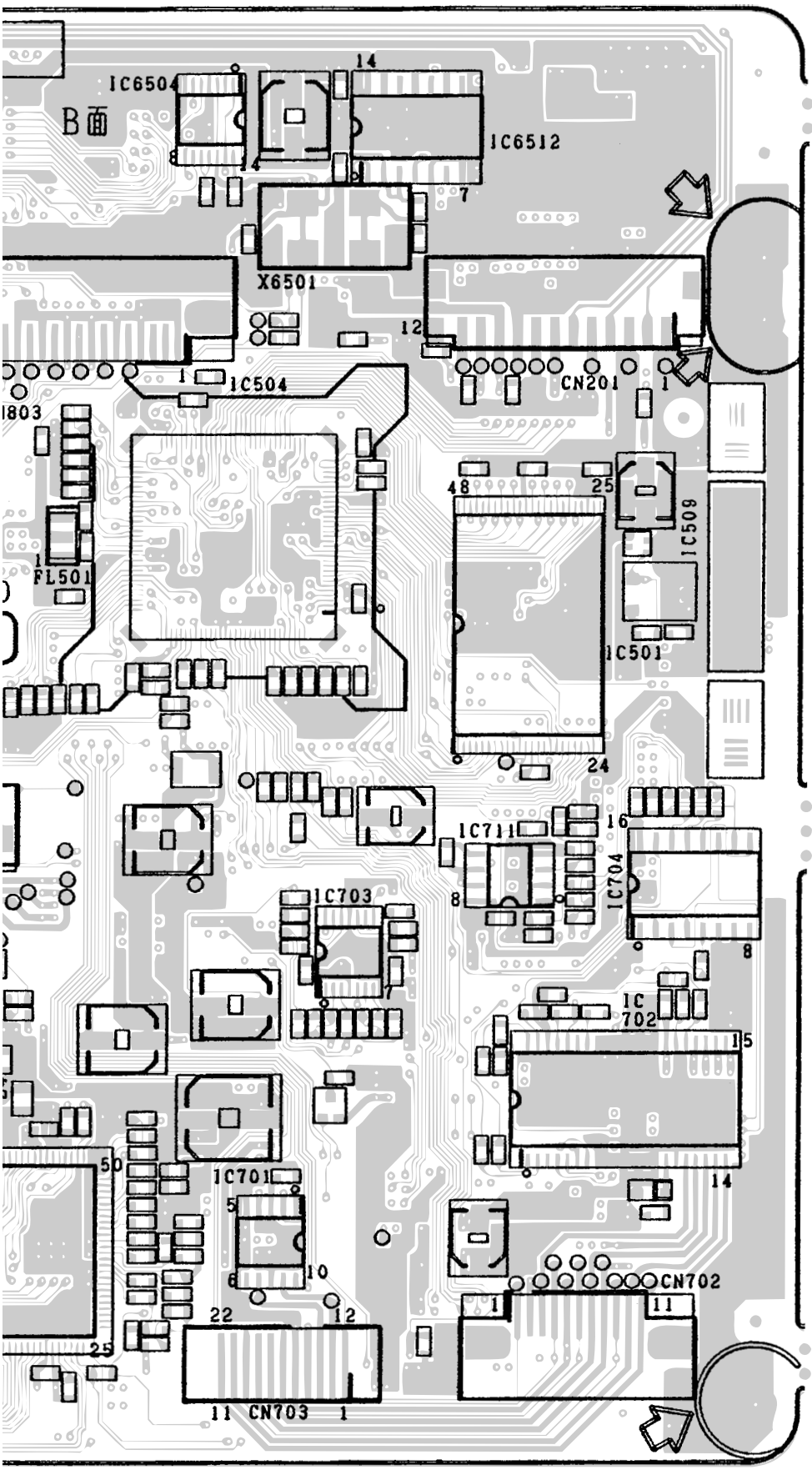


10	11	12	13	14	15	16	17	18	19

15-2. MAIN P.W.B.

Wiring Side

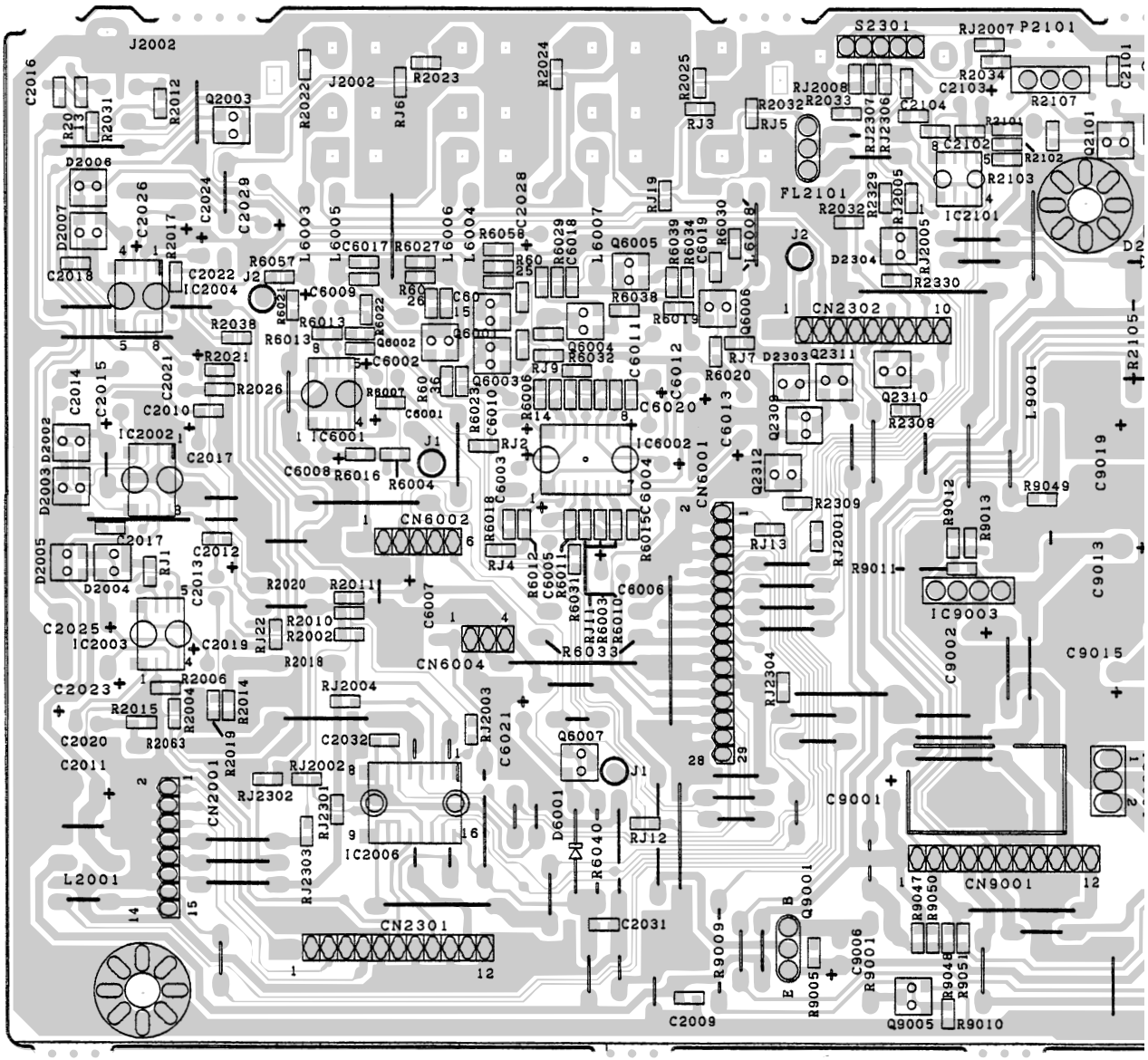




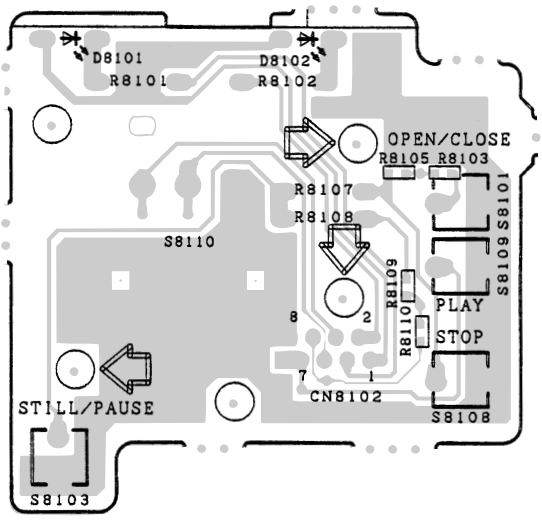
10	11	12	13	14	15	16	17	18	19

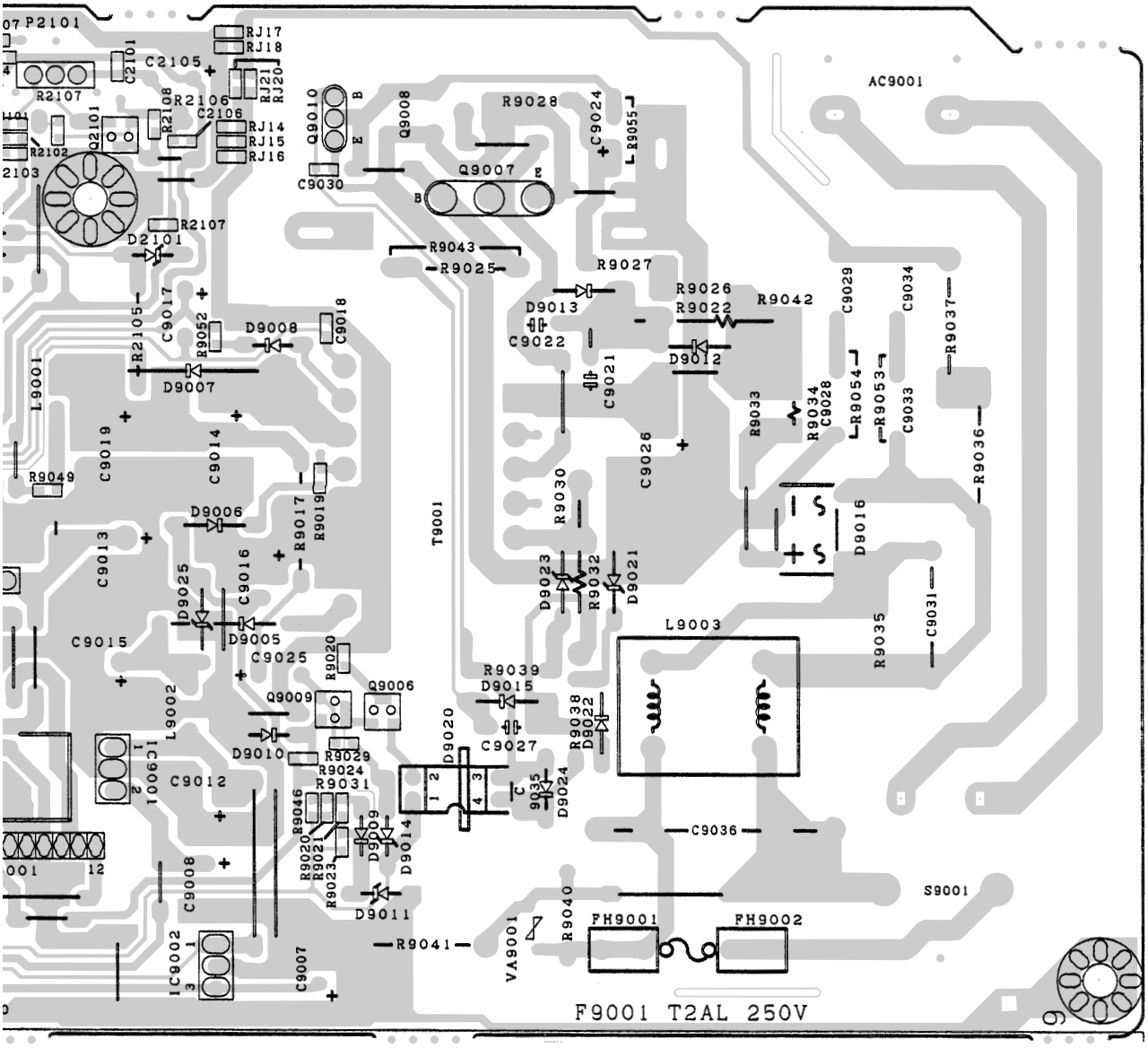
15-3. TERMINAL/OPERATE/VOLUME P.W.B.

TERMINAL

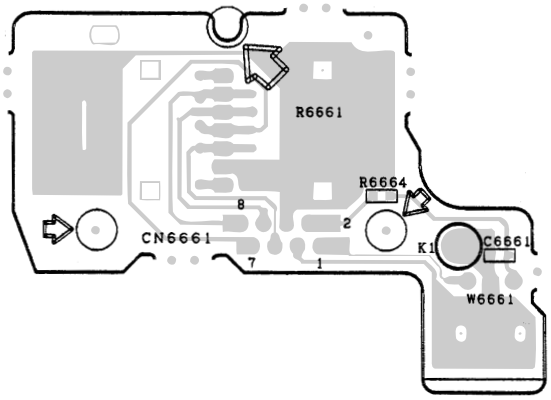


OPERATE





VOLUME

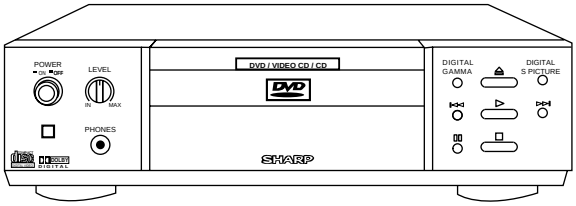


10	11	12	13	14	15	16	17	18	19

SHARP SERVICE MANUAL

S58Q1DV-560H/

DVD VIDEO PLAYER



MODEL DV-560H

In the interests of user-safety (Required by safety regulations in some countries) the set should be restored to its original condition and only parts identical to those specified be used.

CONTENTS

Page

1. IMPORTANT SAFEGUARDS AND PRECAUTIONS 1-1
2. FEATURES/3. SPECIFICATIONS 2-1
4. PART NAMES 4-1
5. MAINTENANCE CHECK ITEMS AND EXECUTION TIME 5-1
6. DISASSEMBLY AND REPLACEMENT OF MAIN PARTS 6-1
7. EXPLANATION OF MECHANISM 7-1
8. OPERATION OF PICKUP 8-1
9. TEST MODE 9-1
10. EXPLANATION OF OPERATION AT THE SYSTEM START 10-1
11. TROUBLESHOOTING 11-1
12. IC FUNCTION LIST 12-1
13. SEMICONDUCTOR LEAD IDENTIFICATION 13-1
14. BLOCK DIAGRAM 14-1
15. WIRING DIAGRAM 15-1
16. SCHEMATIC DIAGRAMS 16-1
17. PRINTED WIRING BOARD ASSEMBLIES 17-1
18. REPLACEMENT PARTS LIST 18-1
19. PACKING OF THE SET 19-1

SERVICE MANUAL DVD VIDEO PLAYER MODEL DV-560H

SHARP CORPORATION

1. IMPORTANT SAFEGUARDS AND PRECAUTIONS

BEFORE OPERATING YOUR NEW DVD PLAYER, PLEASE CAREFULLY READ THIS OPERATION MANUAL AI
THEN SAVE IT FOR FUTURE REFERENCE AS IT WILL BE USEFUL IF YOU HAVE ANY PROBLEMS OPERATII
YOUR DVD PLAYER IN THE FUTURE.

Note:
This unit can be used only where the power supply is AC 110V-240V, 50/60Hz. It cannot be used elsewhere.

CAUTION:

USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

AS THE LASER BEAM USED IN THIS DVD PLAYER IS HARMFUL TO THE EYES, DO NOT ATTEMPT TO DISASSEMBLE THE CABINET. REFER SERVICING TO QUALIFIED PERSONNEL ONLY.

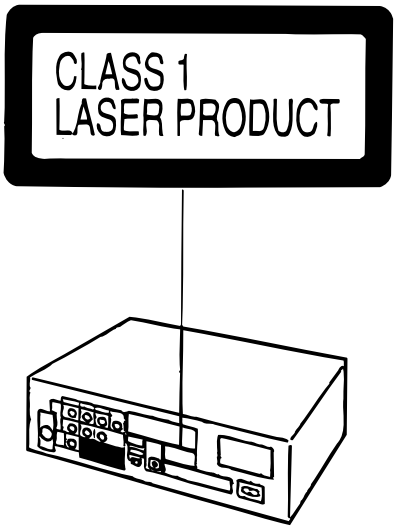
WARNING:

TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.

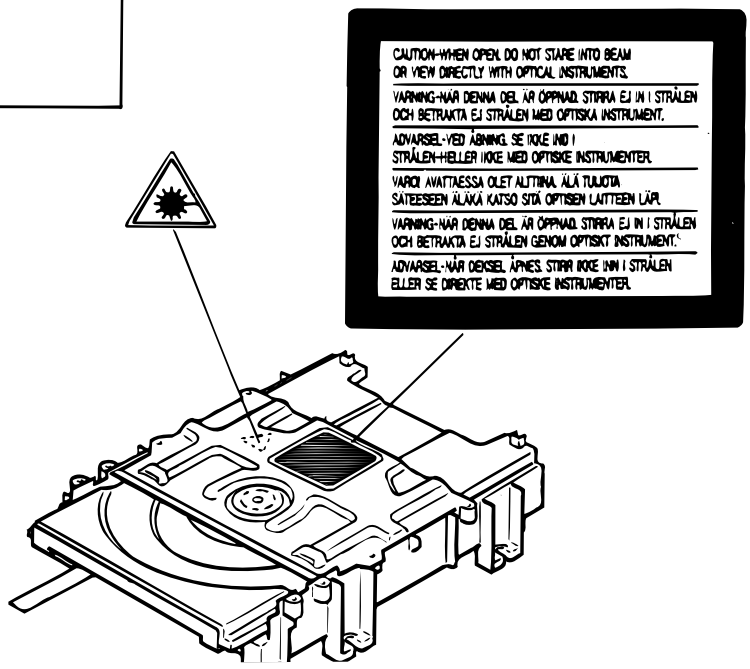
TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, AND ANNOYING INTERFERENCE, USE THE RECOMMENDED ACCESSORIES ONLY.

Laser Diode Properties
Material: AlGaInP
Wave length: 650 nm
Emission Duration: Continuous
Laser output: Max. 0.7 mW

- This DVD player is classified as a CLASS 1 LASER product.
- The CLASS 1 LASER PRODUCT label is locate on the rear cover.
- This product contains a low power laser device To ensure continued safety do not remove any cover or attempt to gain access to the inside of the product. Refer all servicing to qualified personnel.



(Back of product)


CAUTION-WHEN OPEN. DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.
VARNING-NÄR DENNA DEL ÄR ÖPPNAD. STIRRA EJ IN I STRÅLEN OCH BETRAKTA EJ STRÅLEN MED OPTISKA INSTRUMENT.
ADVARSEL-VED ÅBNING. SE IKKE IND I STRÅLEN-HELLER IKKE MED OPTISKE INSTRUMENTER.
VARO! AVATTAESSA OLET ALTTIINA. ÄLÄ TUIJOTA SÄTEESEEN ÄLÄKÄ KATSO SITÄ OPTISEN LAITTEEN LÄPI.
VARNING-NÄR DENNA DEL ÄR ÖPPNAD. STIRRA EJ IN I STRÅLEN OCH BETRAKTA EJ STRÅLEN GENOM OPTISKT INSTRUMENT.
ADVARSEL-NÅR DEKSEL ÅPNES. STIRR IKKE INN I STRÅLEN ELLER SE DIREKTE MED OPTISKE INSTRUMENTER.

2. FEATURES

- Plays DVD, video CD and CD (Digital Audio) discs
- Built-Dulby Digital (AC-3) decoder supporting Dolby Pro Logic* decoding and Virtual Surround
- For the audio on a DVD disc recorded in MPEG Version 2.0 format.
- Digital Gamma correction and Digital Super Picture functions
- Separate colour component output connectors (Y, Cd and Cr)

3. SPECIFICATIONS

Signal System:	NTSC/PAL
Video output:	Output connector: Pin-jack/21-pin Euro-SCART Output level: 1Vp-p (75Ω)
S video output:	Y output level: 1Vp-p (75Ω) C output level: 0.286 Vp-p (75Ω) Output connector: S connector
Component colour output:	Y output level: 1Vp-p (75Ω) Cb output level: 0.7Vp-p (75Ω)/100% colour Cr output level: 0.7Vp-p (75Ω)/100% colour Output connector: Phono
Audio output:	5.1ch output: Front L/R, surround L/R, centre and subwoofer Output connector: Pin-jack/21-pin Euro-SCART Output level: 2Vrms (1kHz, 0dB)
Digital audio I/F:	Optical digital output: Optical connector
Audio output:	Coaxial digital output: Phono
Headphone output:	Output connector: Standard jack
Video signal horizontal resolution:	500 lines
S/N ratio:	60 dB or better
Audio signal frequency characteristics:	For DVD linear PCM playback: 4Hz to 22 kHz (48 kHz sampling) 4Hz to 44 kHz (96 kHz sampling) CD playback: 4Hz to 20 kHz (EIAJ) (MPEG Audio Version 2.0)
S/N ratio:	CD: 96dB, 1kHz (EIAJ)
Dynamic range:	DVD linear PCM: 94 dB (EIAJ) CD: 96 dB (EIAJ)
Overall harmonic distortion ratio:	CD: 0.005% or less (EIAJ)
Operating temperature:	5°C to 40°C
Storange temperature:	–20°C to 55°C
Power supply :	110V to 240V AC, 50/60 Hz
Power consumption:	17W (0W when switched off)
Dimensions:	270 mm × 338 mm × 80 mm (W × D × H) (Including attachments)
Weight:	2.5 kg

Specifications are subject to change without notice.
Weight and dimensions are approximate.

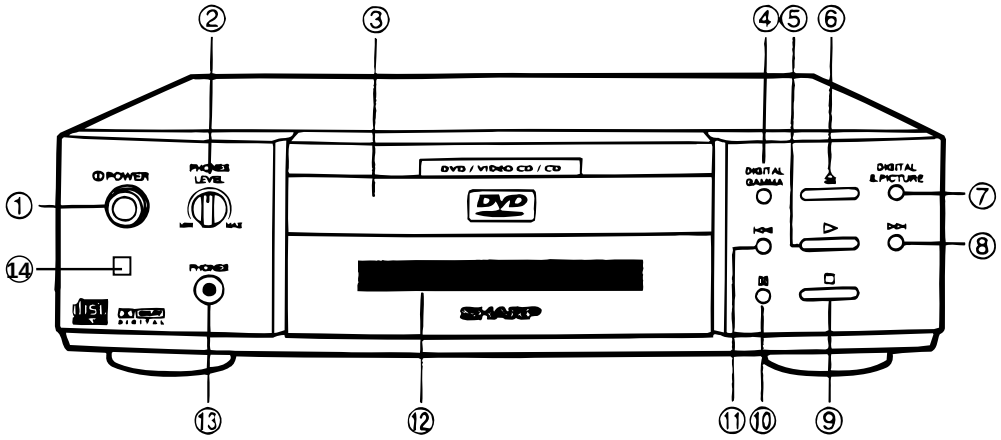
Digital Output
· The digital output format (optical or coaxial) used in this DVD player is linear PCM audio sampling at 44.1 kHz or 48 kHz.
Linear PCM sound for DVD video discs sampled at 96 kHz cannot be output digitally.
Check the disc jacket for information on the audio sampling used.

3-1. ACCESSORIES

Accessories: S-video cord x 1, video/audio cord x 1, AC power cord x 1, UM3 battery x 2,
Remote Control Unit x 1

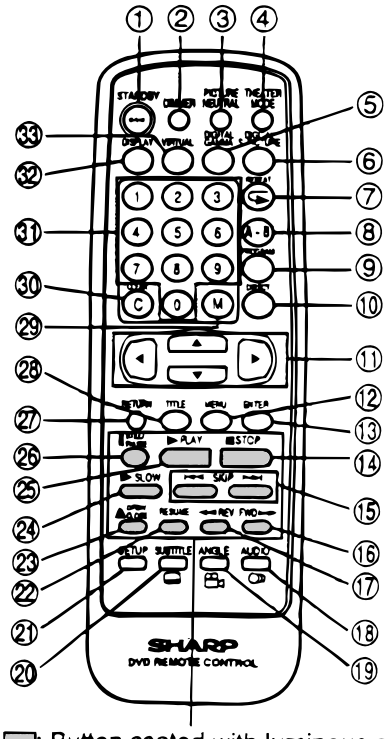
4. PARTS NAME

Main Unit (Front)



① POWER ON/OFF(⏻) button
② PHONES LEVEL knob
③ DISC Tray
④ DIGITAL GAMMA ON/OFF button and indicator
⑤ PLAY (▷) button
⑥ OPEN/CLOSE (⏏) button for tray
⑦ DIGITAL S.PICTURE ON/OFF button and indicator
⑧ SKIP Forward (▷▷|) button
⑨ STOP (□) button
⑩ STILL/PAUSE (▯▯) button
⑪ SKIP Reverse (|◁◁) button
⑫ Front panel display
⑬ PHONES jack
⑭ **Remote Sensor**

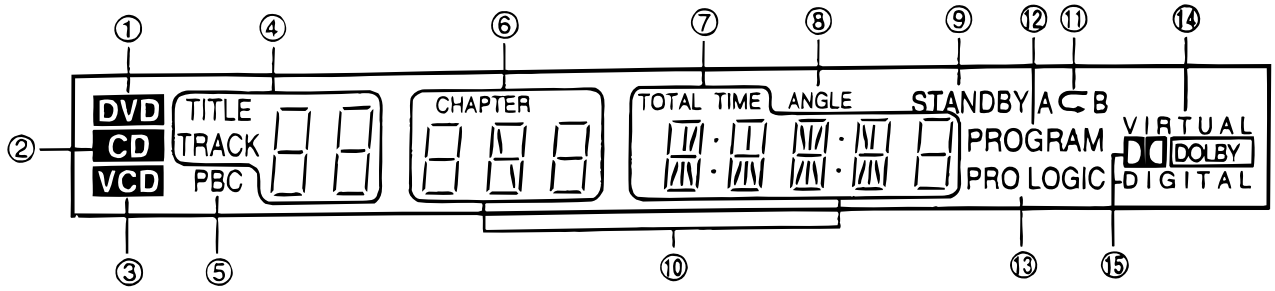
Remote Control



① STANDBY button
② DIMMER button
Use this button to select the front panel display brightness.
③ PICTURE NEUTRAL button
④ THEATER MODE button
⑤ DIGITAL GAMMA button
⑥ DIGITAL S.PICTURE button
⑦ REPEAT button
⑧ A-B (AB repeat) button
⑨ PROGRAM button
⑩ DIRECT button
⑪ ▲/▼, ◀/▶ buttons
⑫ MENU button
⑬ ENTER button
⑭ STOP (■) button
⑮ SKIP (▶▶| SKIP |◀◀) button
⑯ FWD (▶▶) button
⑰ REV (◀◀) button
⑱ AUDIO ( ) button
⑲ ANGLE ( ) button
⑳ SUBTITLE ( ) button
㉑ SETUP button
㉒ RESUME button
㉓ OPEN/CLOSE (⏏) butt
㉔ SLOW button (|▶)
㉕ PLAY (▶) button
㉖ STILL/PAUSE (▮▮) button
㉗ RETURN button
㉘ TITLE button
㉙ M (Memory) button
㉚ CLEAR button
㉛ Number buttons
㉜ DISPLAY (OSD) button
㉝ VIRTUAL button

: Button coated with luminous paint.

Front Panel Display



The figure above shows the front panel with all the displays on.

① Lights when a DVD is loaded
② Lights when an audio CD is loaded
③ Lights when a Video CD is loaded
④ Shows the title number [DVD only]/Shows the track number [Video CD and Audio CD]
⑤ Lights during video CD with playback control only
⑥ Shows the chapter number [DVD only]
⑦ Shows the total time elapsed since the disc started playing.
⑧ Lights when it is possible to switch the angle. [DVD only]
⑨ STANDBY indicator
- If no further buttons are pressed within 5 minutes of the last button being pressed, the startup (stop) screen disappears.

- Thirty minutes after the last button was pressed, all buttons other than PLAY and OPEN/CLOSE are disabled. Pressing either PLAY or OPEN/CLOSE re-enables all the other buttons.

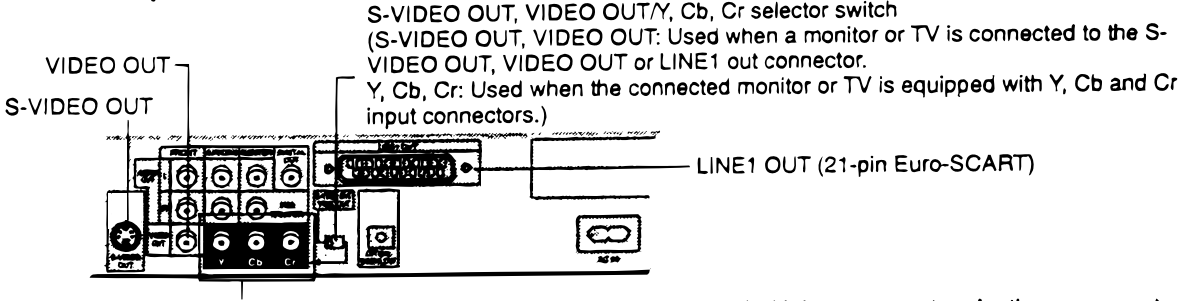
⑩ Operating mode indicator (Messages)
<Display examples>

NO DISC	REV
OPEN	STILL
LOAD	PAUSE
STOP	CLOSE
PLAY	SLOW
FWD	

⑪ Lights during repeat play
⊂ : Repeat A⊂B: A-B repeat
⑫ PROGRAM indicator
Lights during PROGRAM play.
⑬ PRO LOGIC indicator
⑭ Virtual Surround indicator
⑮ Dolby Digital (AC-3) indicator

Main Unit (Rear)

Using the Component Colour (Y, Cb and Cr) Output Connectors


S-VIDEO OUT, VIDEO OUT/Y, Cb, Cr selector switch
(S-VIDEO OUT, VIDEO OUT: Used when a monitor or TV is connected to the S-VIDEO OUT, VIDEO OUT or LINE1 out connector.
Y, Cb, Cr: Used when the connected monitor or TV is equipped with Y, Cb and Cr input connectors.)
VIDEO OUT
S-VIDEO OUT
LINE1 OUT (21-pin Euro-SCART)

Colour Output Connectors (Y, Cb and Cr): Some TVs and monitors are equipped with input connectors for the component colour signals (Y, Cb and Cr). By connecting these input connectors to the corresponding output connectors on the DVD player, you can enjoy higher quality playback images. If you are using a TV or monitor equipped with Y, Cb and Cr connectors, use these connectors rather than the VIDEO OUT or S-VIDEO OUT connector.
If you are using the Y, Cb and Cr connectors, set the S-VIDEO OUT, VIDEO OUT/Y, Cb, Cr selector switch to "Y, Cb, Cr".

5. MAINTENANCE CHECK ITEMS AND EXECUTION TIME

MECHANICAL PARTS REGUIRING PERIODICAL INSPECTION

Use the following table as a guide to maintain the mechanical parts in good operating condition.

Parts \ Maintained	1,000 hrs.	2,000 hrs.
Pickup	○	○
Spindle Unit	□	○
Sled Motor		○
Loading Motor		○
Belt	□	○

Note ○ : Part Replacement
□ : Cleaning
(For cleaning, use a lint-free cloth danpened with pure isopropyl alcohol.)

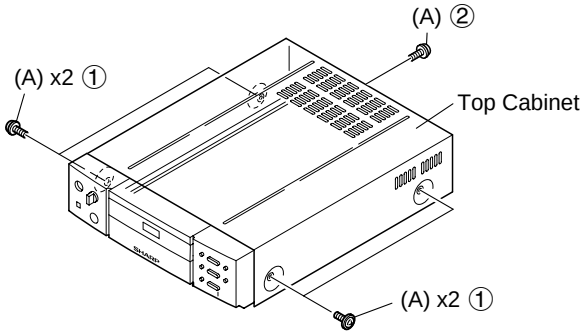
CARES WHEN USING THE PICKUP

1. The laser light having wavelength 650 nm is emitted from the objective lens. BE CAREFUL SO THAT THE LASER LIGHT DOES NOT ENTER DIRECTLY INTO YOUR EYE.
2. The semiconductor laser may be easily damaged by electrostatic charges. When handling the pickup, take care so that the electrostatic charge is not generated.
3. The semiconductor laser may be easily damaged by overcurrent. Use the power supply unit which does not give any spike current when the power is turned on and off.
4. Carefully remove the dust and dirt from the objective lens with the lens blower.
   When handling the objective lens, take due care so that it is not contaminated with fingerprint, etc. If the objective lens is contaminated, impregnate the cleaning paper with a small quantity of solvent (isopropyl alcohol), and gently wipe to clean.
5. The ozone layer depleting components (ODC) are not used in the production process for the product.

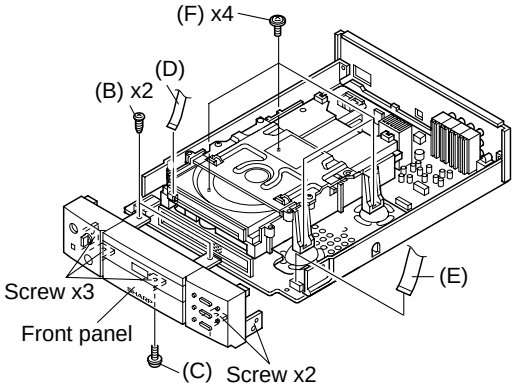
6. DISASSEMBLY AND REPLACEMENT OF MAIN PARTS

6-1. DISASSEMBLY

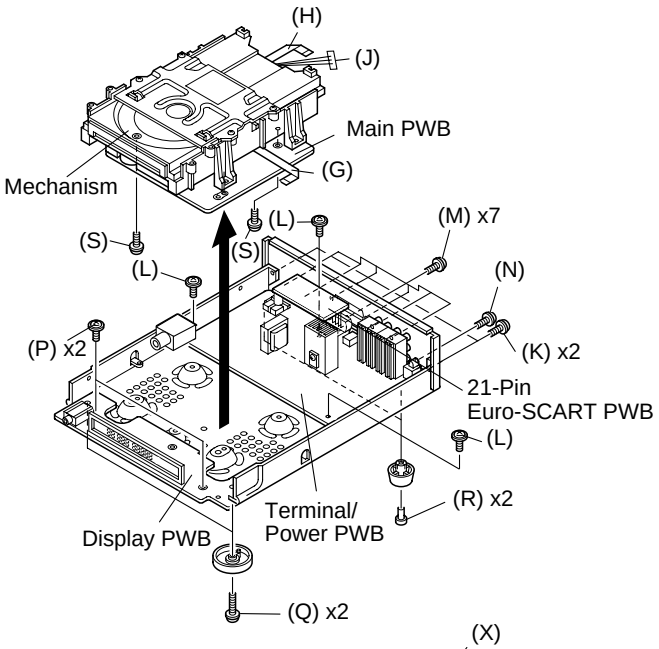
1. Remove five screws (A), and remove the cabinet.
   Note: When assembling it, tighten the screws in order of ①-②. (Because the set may rise a little by tightening the screws.)



2. Remove two screws (B).
3. Remove one screw (C).
4. Release the hooks of the front panel at two places on both sides and at three places on the bottom, and slide the front panel toward you.
5. Disconnect the connectors (D) and (E).
6. Remove four screws (F) which installs the mechanical unit.

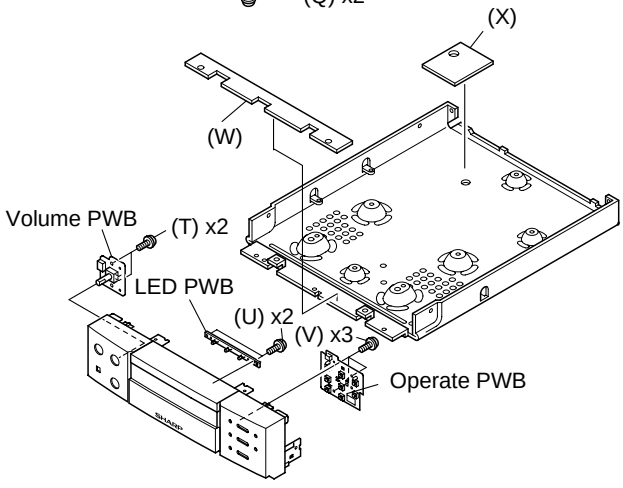


7. Disconnect the lead lines (G) and (H) and (J) from the main PWB under the mechanism.
8. Remove two screws (K) on both sides of the terminal angle frame.
9. Remove three screws (L) which install the terminal/power PWB.
10. Remove seven screws (M) and one screw (N) which install the terminal block.
11. Remove two screws (P) of the display PWB.
12. Remove two screws (Q) of the decorative leg.
13. Push out the middle pin (R) of the setting leg in the direction opposite to insertion. (Two places)
14. Remove two screws (S) which install the main PWB under the mechanical unit.



15. Remove two screws (T) which install the volume PWB of the front panel.
16. Remove the LED PWB and two holder screws (U).
17. Remove three screws (V) which install the operate PWB.

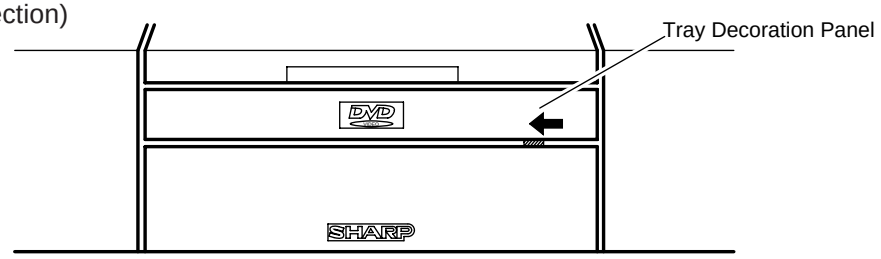
* The spacer and insulation seat under the indication tube of (W) and (X) are bonded with both-side sticking tape.



6-2. REPLACEMENT OF MAIN PARTS

<Disassembling and assembling procedure>

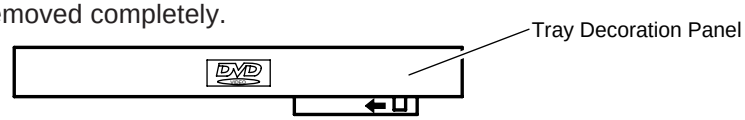
· Removing the tray (emergency ejection)
  Removing the tray lock (set state)



Insert a thin plate into the hatching part, slowly move the it in the arrow direction so that the tray is moved out a little in the arrow direction.

Note: In this state the tray cannot be removed completely.

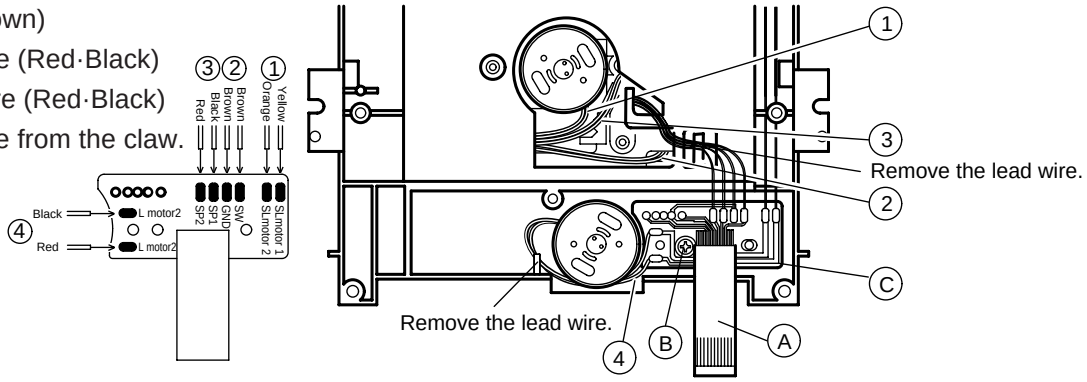
· Drive Unit State



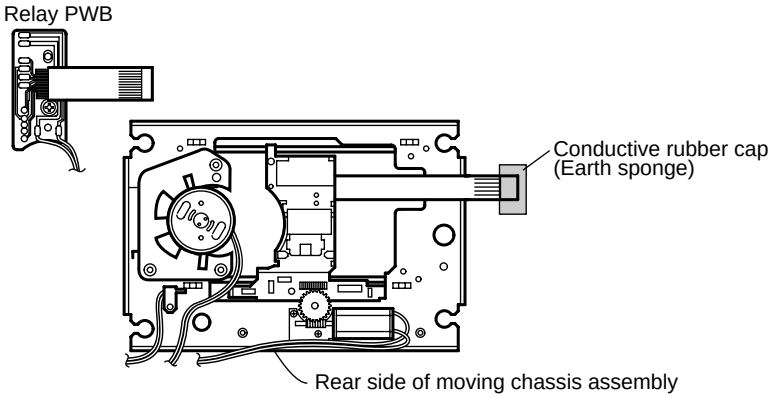
Slowly move in the arrow direction, using the screwdriver having a fine head.

<Disassembling and assembling the mechanism chassis>

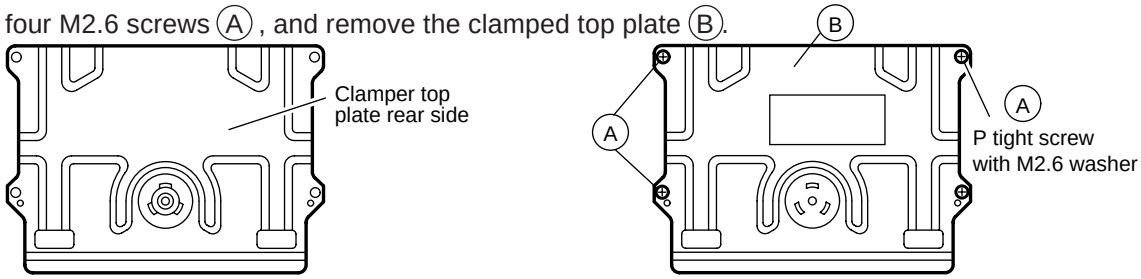
1. Remove the pickup FPC and loading relay FFC Ⓐ from the main PWB.
   Note: Fit the conductive rubber cap to the front end of pickup FPC (short-circuit).
2. Remove the solder joint of loading relay PWB at drive unit rear side.
   ① Sled motor lead wire (Yellow·Orange)
   ② IN SW lead wire 2 (Brown)
   ③ Spindle motor lead wire (Red·Black)
   ④ Loading motor lead wire (Red·Black)
   ⑤ Remove each lead wire from the claw.



3. Remove the relay PWB mounting screw Ⓑ (M2.6S + 6S S tight), and remove the relay PWB Ⓒ.



4. Disassembling the mechanism chassis moving chassis assembly
   (1) Remove the four M2.6 screws Ⓐ, and remove the clamped top plate Ⓑ.

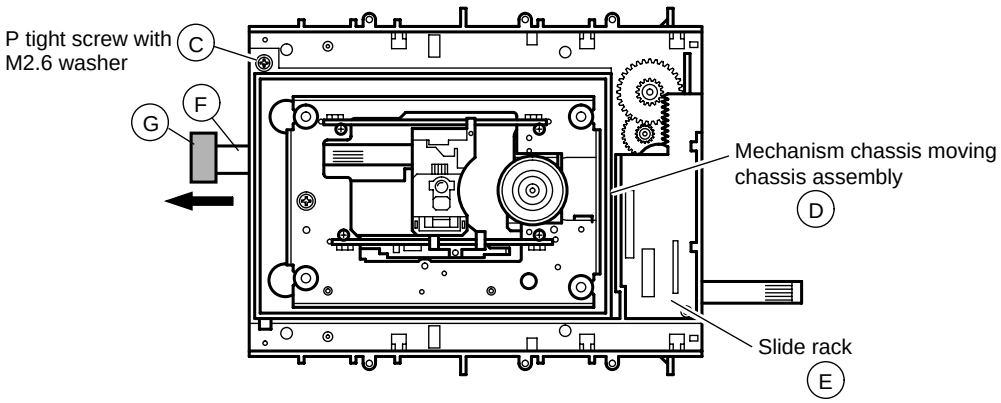


(2) Remove the M2.6 screw Ⓒ .

(3) Holding aslant upward the mechanism chassis moving chassis assembly Ⓓ in the arrow direction, remove.

Note: The slide rack Ⓔ must be moved to the left side as shown in diagram.

Take care so that the lead wires, especially the earth sponge Ⓖ at the pickup FPC Ⓕ front end, must not be removed.



5. Disassembling the loading drive system

(1) Remove the two M2 screws Ⓐ .

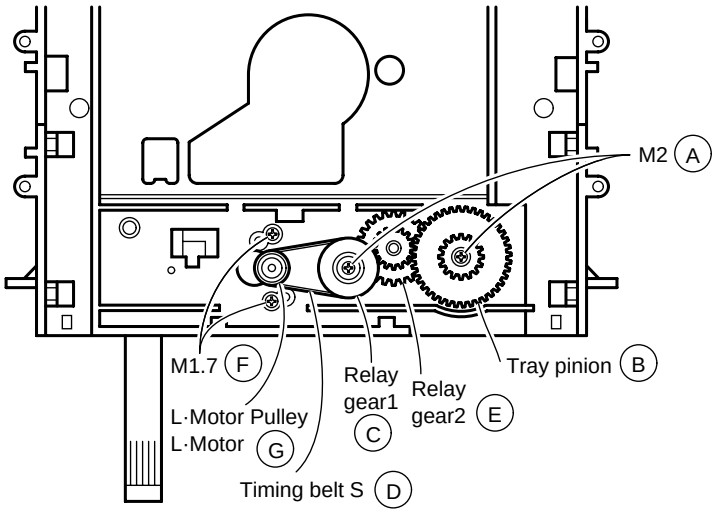
(2) Remove the tray pinion Ⓑ .

(3) Remove the relay gear 1 Ⓒ together with the timing belt S Ⓓ .

(4) Relay gear 2 Ⓔ .

(5) Remove the two M1.7 screws Ⓕ .

(6) Remove the L motor Ⓖ (with pulley) downward.

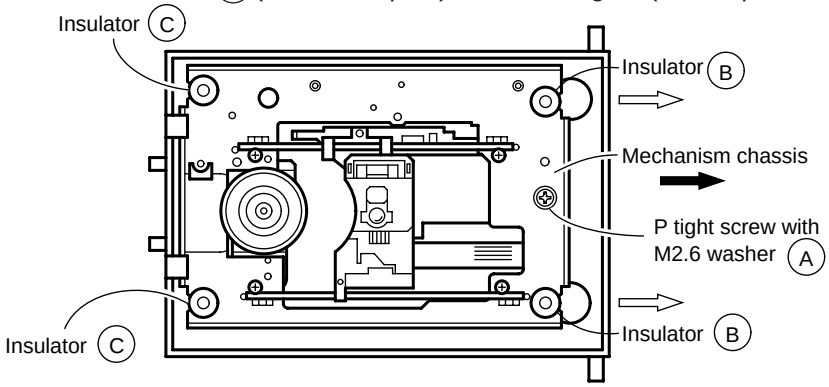


6. Disassembling the mechanism chassis from the moving chassis

(1) Remove the M2.6 screw Ⓐ .

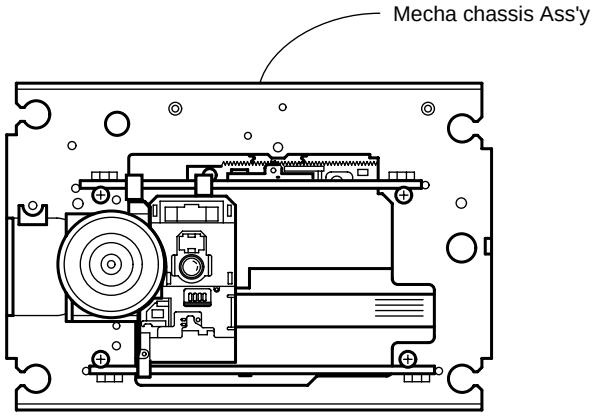
(2) Remove the insulator Ⓑ (2 pcs. at the right side in diagram) parallel in the arrow direction.
(At this time it is better to insert the fine head of screw driver at the ID side of insulator and to move in the arrow direction, which facilitates removal.)

(3) Remove the mechanism chassis in the arrow direction, pulling upward aslant.
At this time take care so that the insulator Ⓒ (left side, 2 pcs.) is not damaged. (Do not put at once the mechanism chassis assembly.)



7. Replacing the pickup and the spindle motor

Since the pickup optical axis and turntable inclination of DVD are adjusted with higher accuracy than of CD/MD, make a replacement as a mechanism service chassis ass'y (refer to Parts List).



8. Replacing the Sled Motor

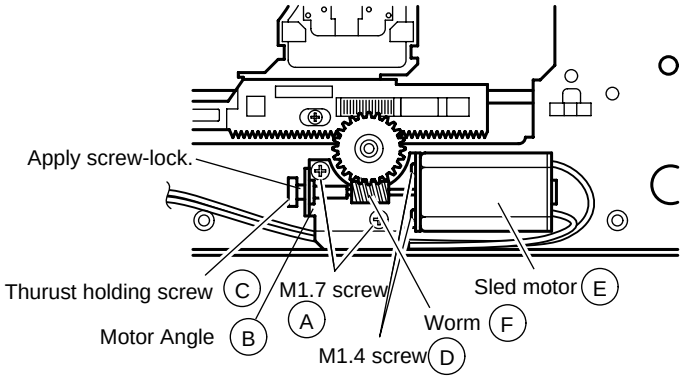
(1) At the rear side of chassis remove the two M1.7 screws Ⓐ, and remove the motor angle Ⓑ.

(2) Remove the thrust holding screw Ⓒ (for easier removing wipe off the thread lock).

(3) Remove the two motor fitting screws M1.4 Ⓓ, and replace the motor Ⓔ. Motor is replaced in the state while the worm Ⓕ is kept press-fitted to the output shaft.

Note: When installing the motor, take care so that the worm does not damage the ANG Ⓑ hole.

(4) Screw in the thurust holding screw Ⓒ, adjust the worm front end clearance to 0 to 0.1 mm, and apply screw lock.



7. EXPLANATION OF MECHANISM

(1) Tray loading mechanism

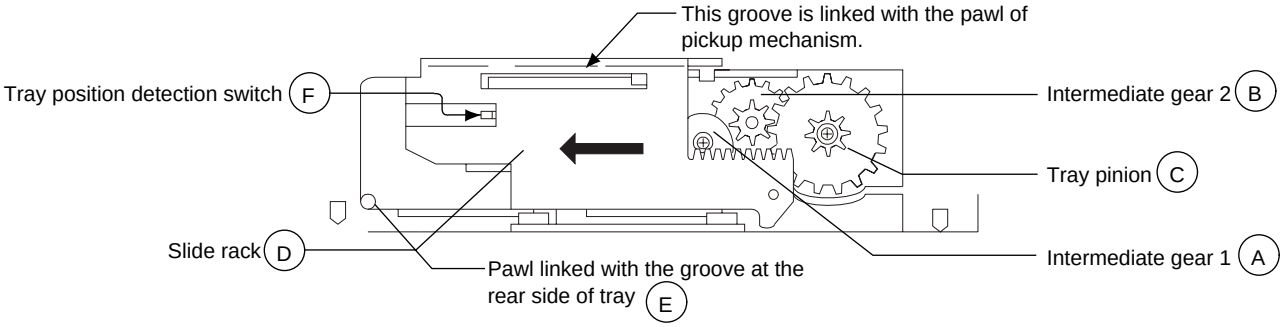
When the tray loading motor rotates counterclockwise, motion is transmitted to the slide rack Ⓓ through the intermediate gear 1 Ⓐ, intermediate gear 2 Ⓑ and tray pinion Ⓒ, resulting in insignificant motion in the arrow direction.

The slide rack is linked with the operating chassis. It lowers the pickup mechanism.

The protrusion of slide rack Ⓔ is linked with the tray through the groove at the rear side of tray, so that the tray is pushed ahead a little. When the tray is pushed out, the slide rack is disconnected from the tray pinion, and at the same time the gear at the rear side of tray is connected with the tray pinion, and the tray is pushed ahead.

When the tray is pushed out fully, the slide rack moves further in the arrow direction through the groove at the rear side of tray. The tray position detection switch Ⓕ is turned on, and the tray loading motor stops.

When the tray closes the operation is as follows. If the tray OPEN/CLOSE button or tray is pressed and the detection switch is turned off, the tray loading motor rotates clockwise, so that the tray is retracted. When the detection switch is turned on again, the tray loading motor stops.


This groove is linked with the pawl of pickup mechanism.
Tray position detection switch F
Intermediate gear 2 B
Tray pinion C
Slide rack D
Intermediate gear 1 A
Pawl linked with the groove at the rear side of tray E

(2) Pickup feed mechanism

When the sled motor Ⓐ rotates, the rack Ⓒ moves through the sled pinion Ⓑ so that the pickup Ⓓ is moved to the internal or external periphery.

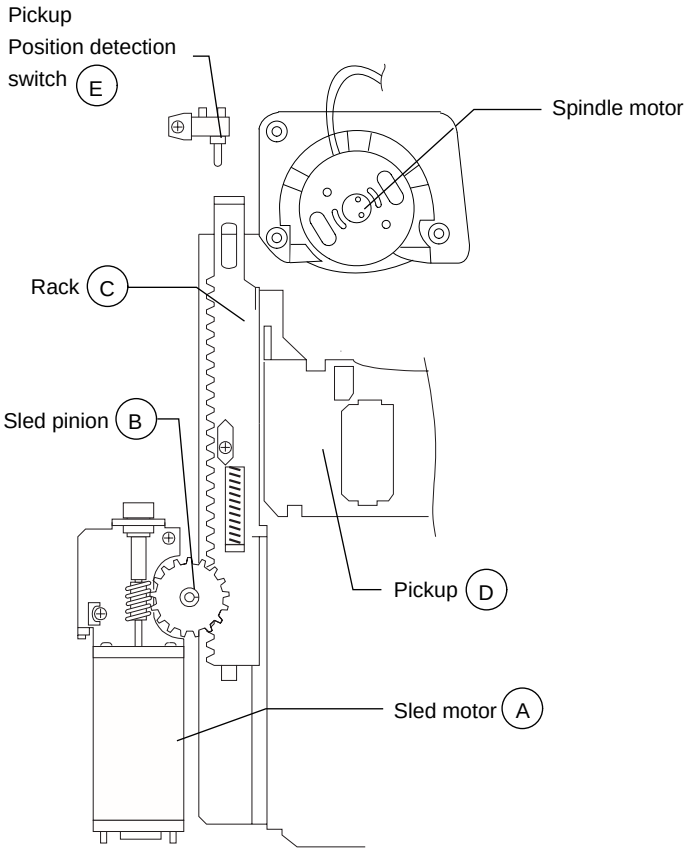
When it is moved to the innermost periphery, the position detection switch Ⓔ is pushed by the rack, so that the position of pickup is initialized.

(3) Disc rotation mechanism

The spindle motor is used to rotate.

IC701 is used to control.

When the spindle motor is replaced, replace the spindle unit.

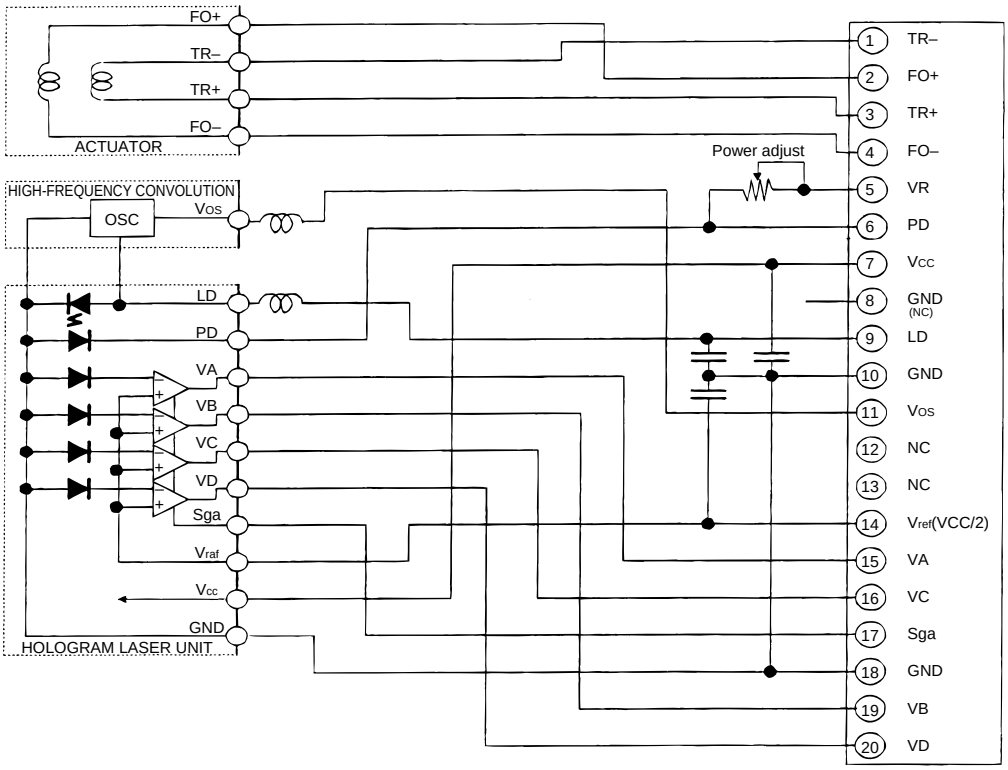


8. OPERATION OF PICKUP

8-1. CIRCUIT CONFIGURATION OF PICKUP

The pickup unit reads signals from the disk, and the flexible cable is connected to the board. The following signals flow through the cable.

8-2. EQUIVALENT CIRCUIT OF PICKUP



8-3. POLARITIES OF SIGNAL

Focus FO+, FO-	When electric current is flowed from FO+ to FO-, the lens comes to near the disk.	
Tracking TR+, TR-	When electric current is flowed from TR+ to TR-, the lens goes toward the outer circumference.	
Gain switching Sga	DVD one Layer	Low gain Sga : GND
	DVD two Layer CD	High gain Sga : +5V

8-4. SIGNALS OF PICKUP

8-4-1. Tracking drive signal (TR+, TR-)

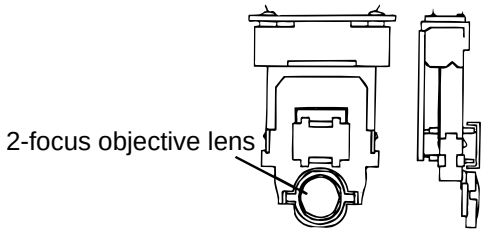
The signal drives the tracking servo mechanism which projects the beam on the track by moving the objective lens (OL) to the outer or inner circumference (at a right angle against the track) of the disk.

Since an eccentricity error of 25 μmP-P is generated due to the eccentricity of 100 μmP-P of the DVD disk when the disk is fixed, the error is reduced to ± 0.22 μm or less with the tracking servo.

8-4-2. Focus drive signal (FO+, FO-)

The signal drives the focus servo mechanism which aligns the focus on the bit of the disk by elevating OL (vertically against the disk surface.)

Since an error of 67 μmP-P is produced by the turn table due to the surface run-out of ± 300 μm of the DVD disk, the error is reduced to ± 0.23 μm or less with the focus servo.



Actuator assembly

8-4-3. Monitor diode bias voltage (VR)

The bias voltage of the monitor diode in the pickup is set. The reference voltage VCC is supplied from 1X1462.

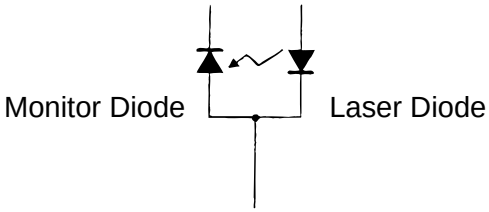
8-4-4. Monitor Diode (PD)

Since the laser diode largely varies output of the laser light even if the flowing current is slightly varied, the projection light is detected with the monitor diode to control the laser light to be equally output.

Since the backward current varies on the monitor diode according to the intensity of the received light of the laser diode, the drive current of the laser diode is reduced if the backward current of the monitor diode increases. On the contrary, the drive current of the laser diode is increased if the backward current of the monitor diode decreases.

As the projection light of the laser diode becomes stronger, the backward current of the monitor diode increases to increase the current which flows into the monitor diode output (PD). Then, the emitter current of Q309 decreases to drop the voltage of the collector of Q310. This is input to the pin 50 of IC304 and is compared with the reference voltage to control the drive current of the laser diode.

The circuit is called ALPC (Automatic Laser Power Control).



Basic Structure of Laser Diode

8-4-5. Laser diode drive current control (LD)

Power supply to drive the laser diode

8-4-6. High-frequency convolution module power supply (VOSC)

The high-frequency convolution imposes the high-frequency signal on the DC current to impose the high frequency on the drive current of the laser. Thus, the noise included in the light reflected on the disk surface can be reduced.

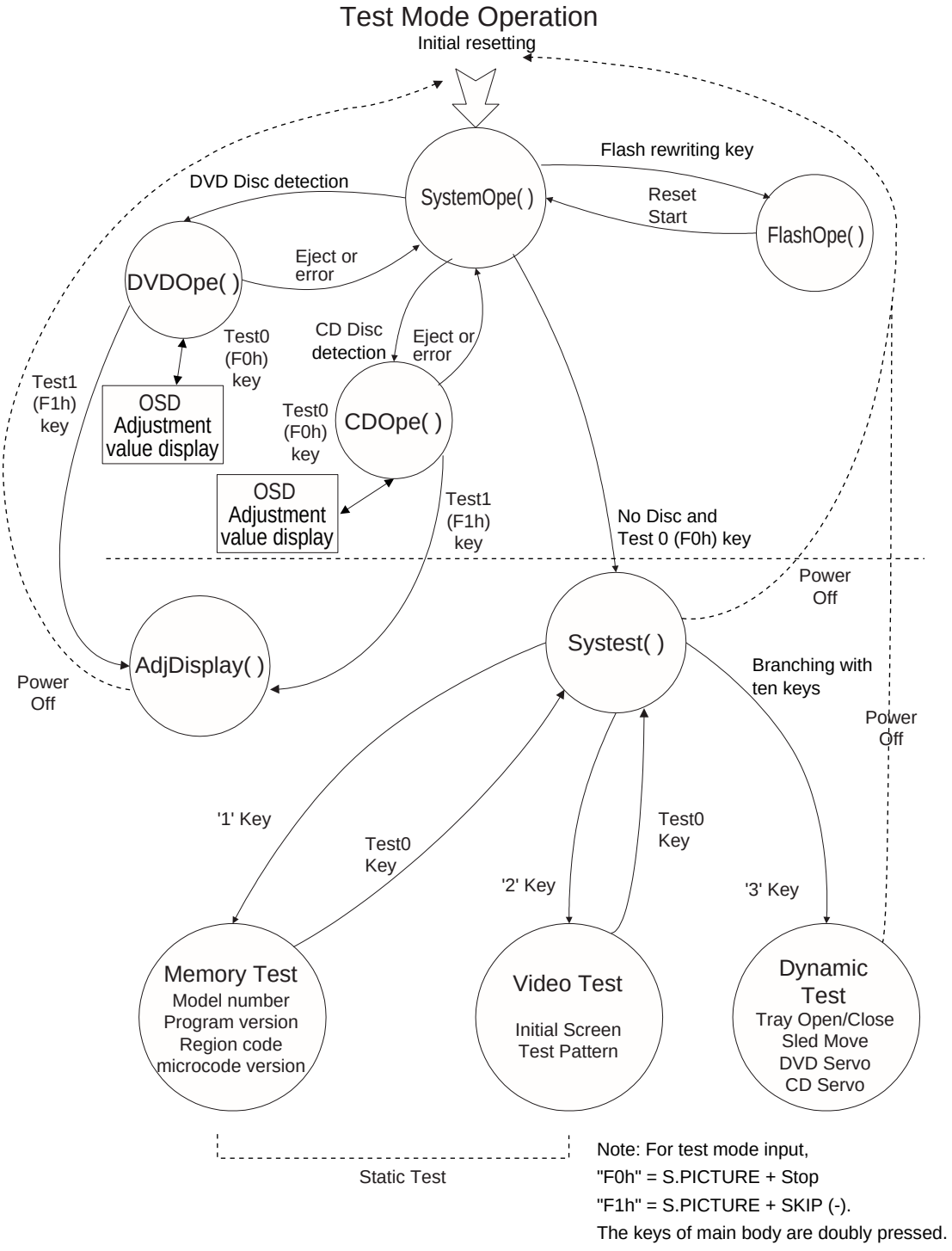
8-4-7. HF Signal (VA, VB, VC, VD)

Signals recorded in the disk

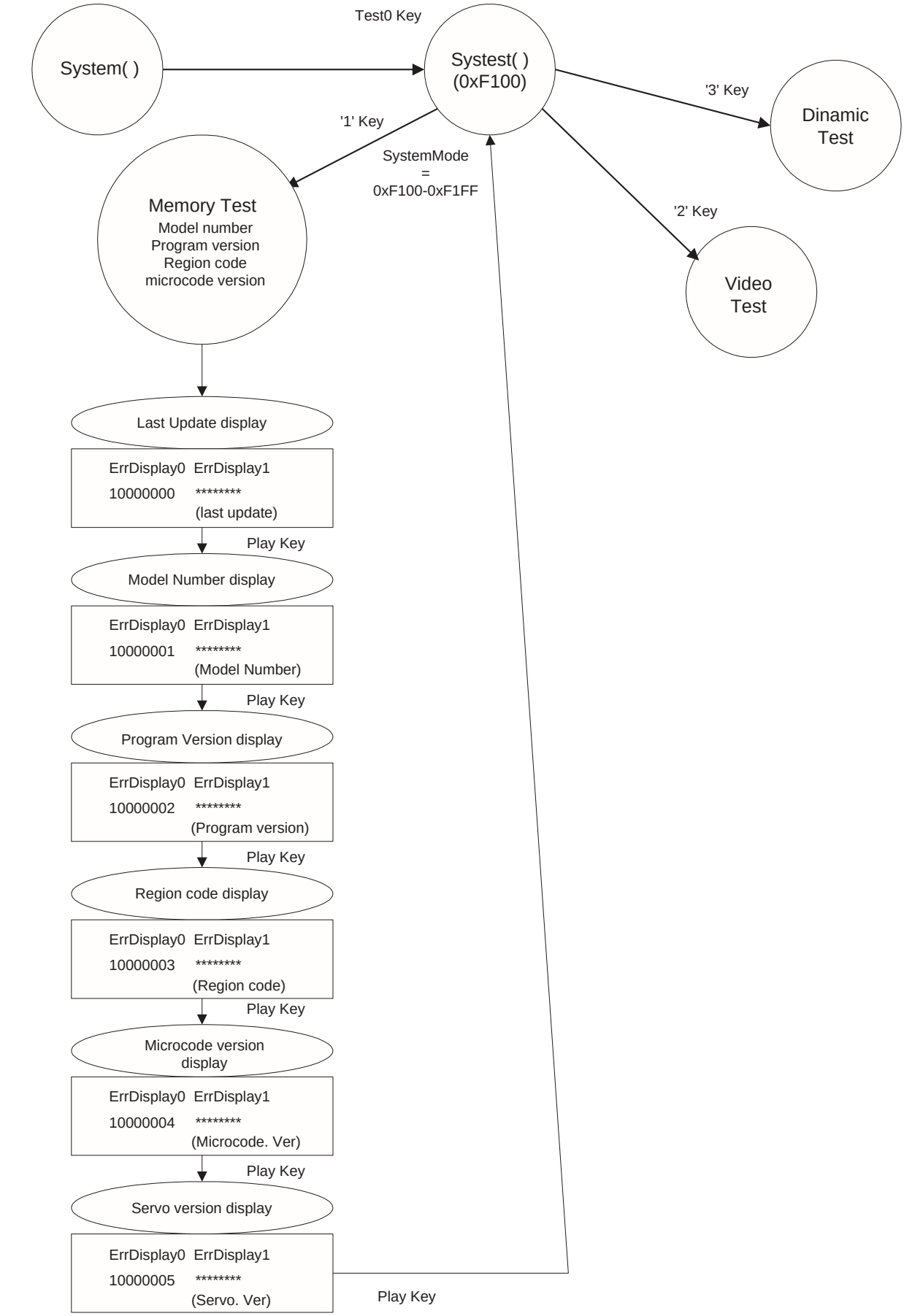
9. TEST MODE

Memory Test Mode	Program version indicaiton.
Video Test Mode	Ordinary test pattern indication, and copy guard signal added test pattern indication are given.
Mecha Test Mode	Servo system initialization, tray opening and closing, laser, servo, continuous playback, jump test are performed.
Servo adjustment value read mode	Sub CPU version indication, VC/FE/TE/RF AVRG, TRVSC, RF LEVEL, FO BIAS, FO GAIN, TR GAIN indication are given.

10. EXPLANATION OF OPERATION AT THE SYSTEM START

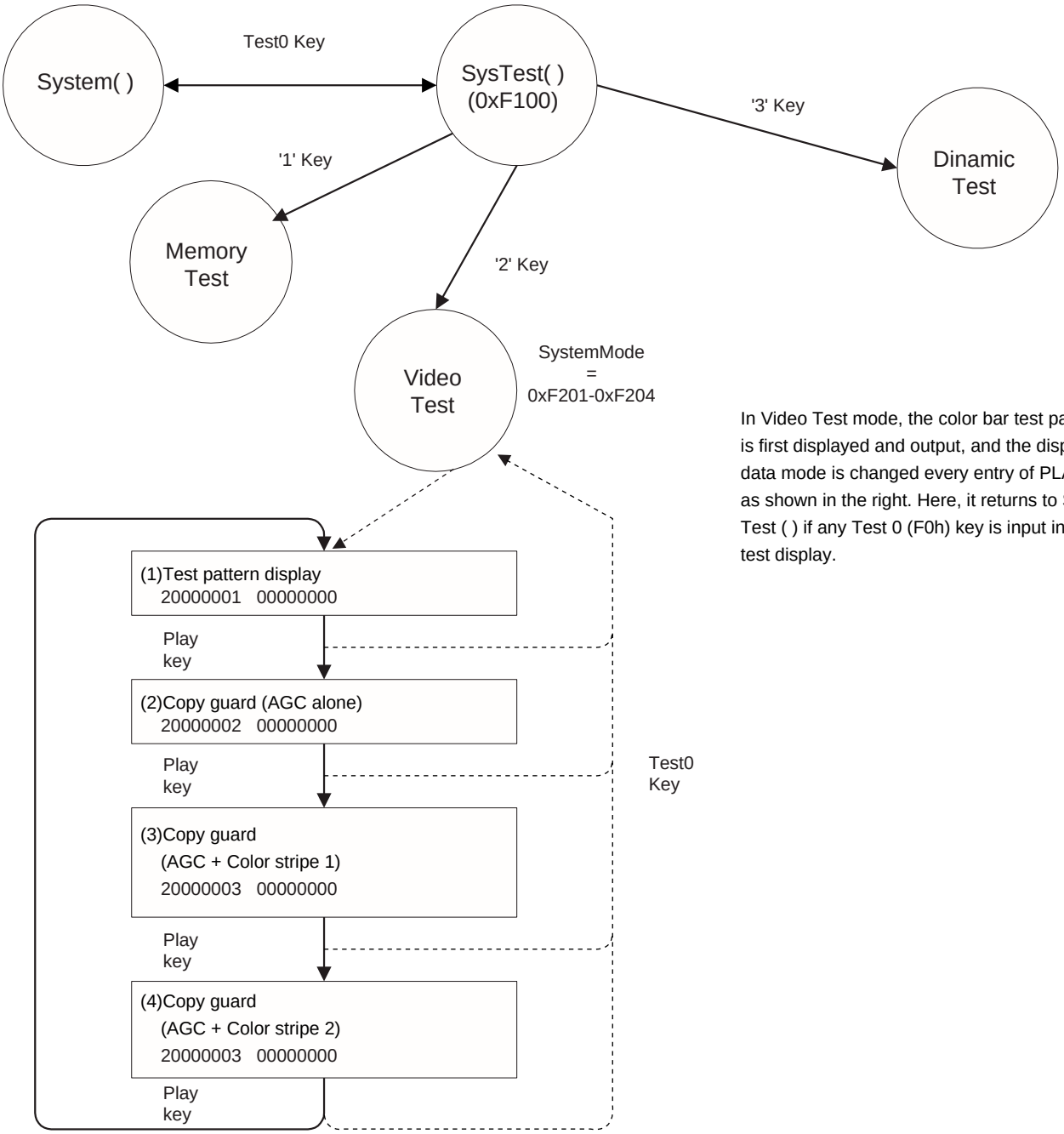


Transition of test mode status (1)
Memory Test



Transition of test mode status (2)

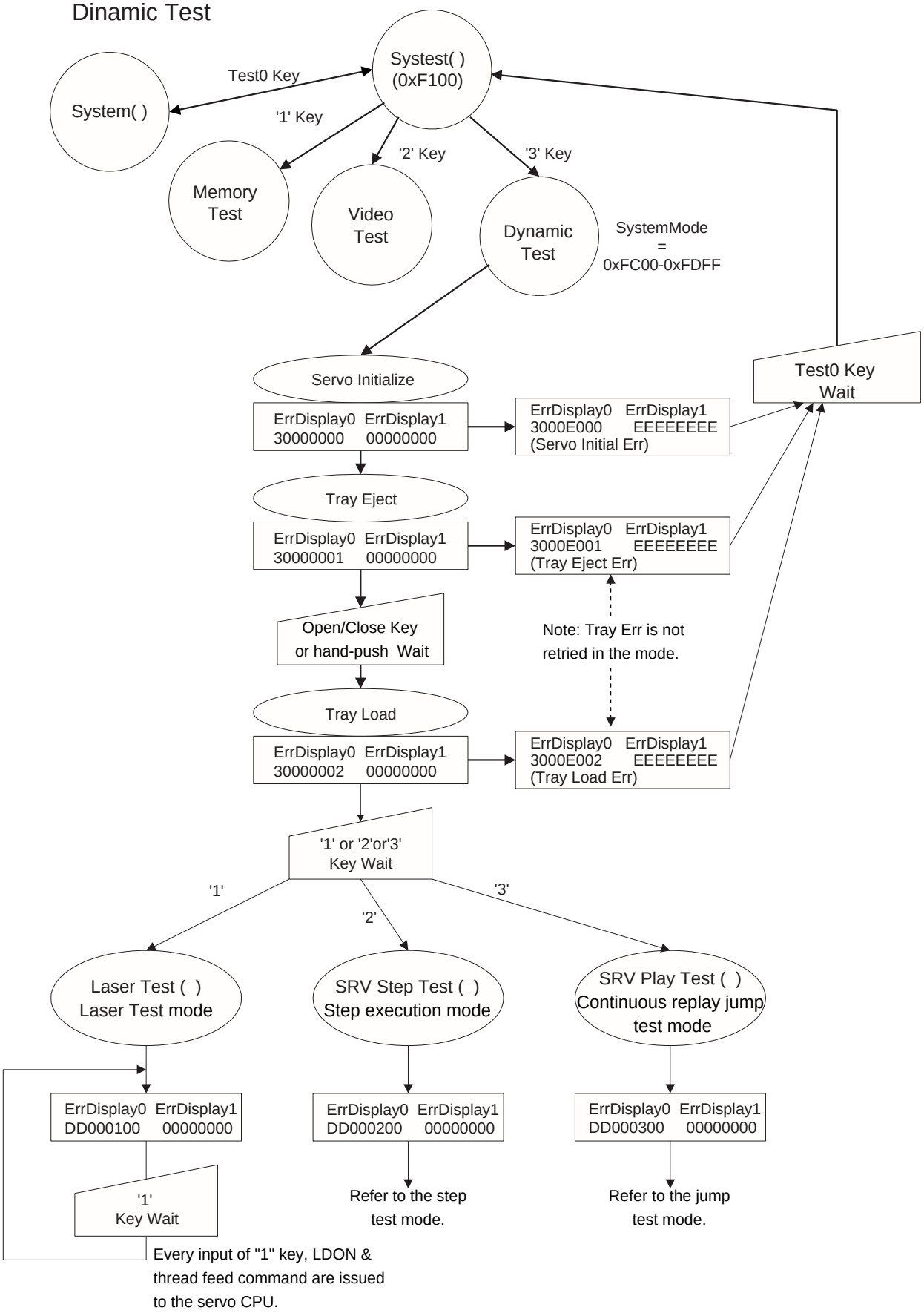
Video Test



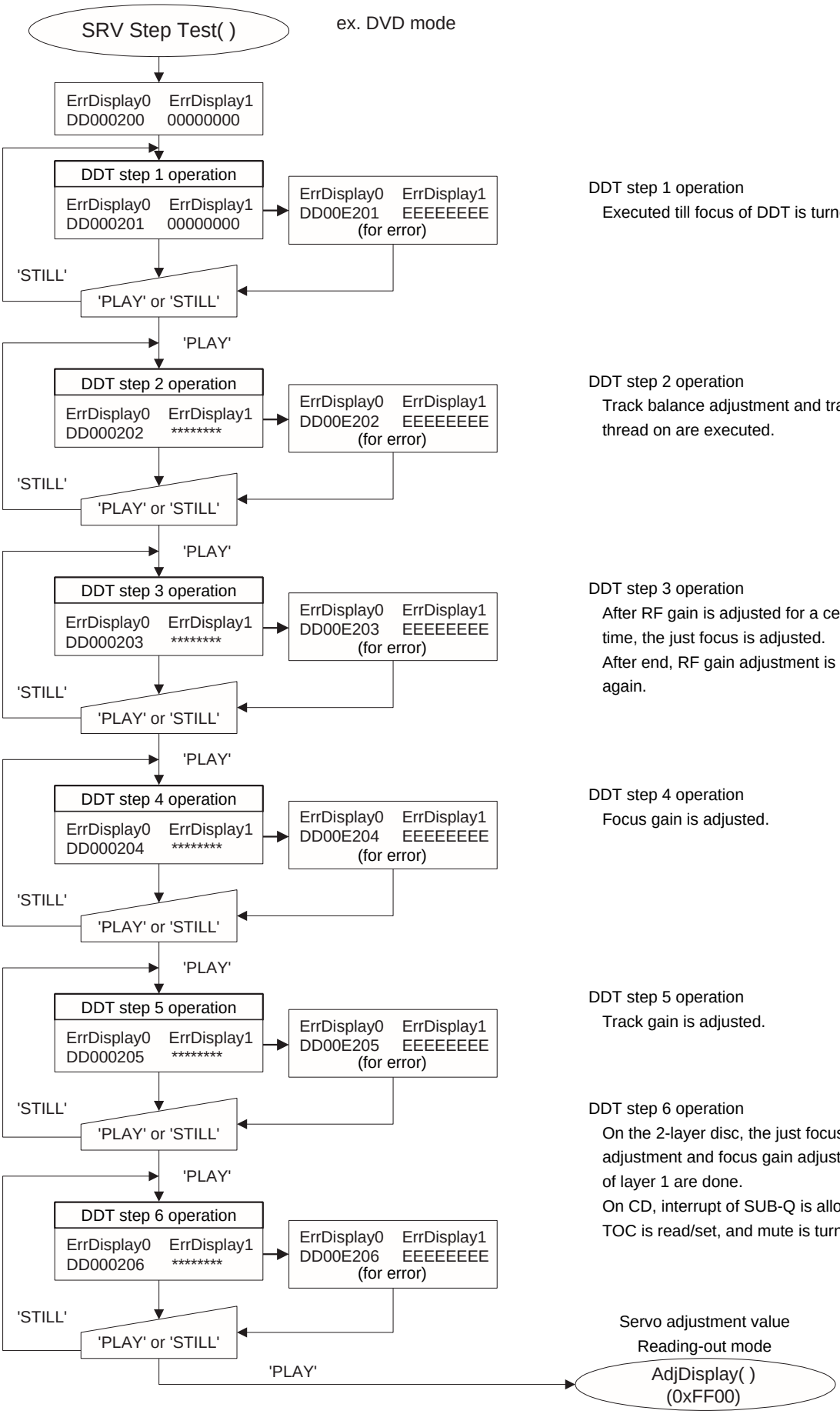
In Video Test mode, the color bar test pattern is first displayed and output, and the display data mode is changed every entry of PLAY key as shown in the right. Here, it returns to Sys Test ( ) if any Test 0 (F0h) key is input in the test display.

Transition of test mode status (3)

Dinamic Test



SRV Step Test( )
Step Test Mode



DDT step 1 operation
Executed till focus of DDT is turned on.

DDT step 2 operation
Track balance adjustment and track thread on are executed.

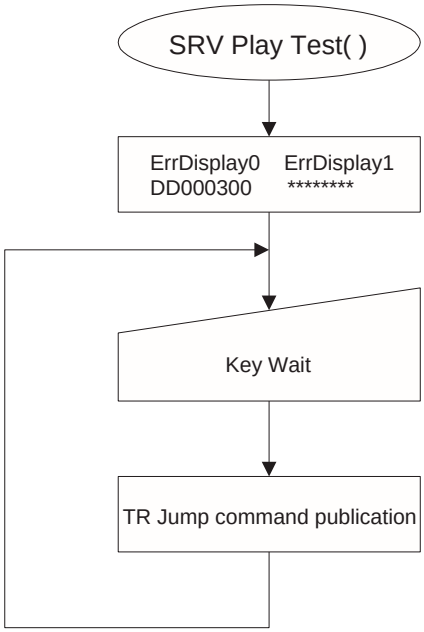
DDT step 3 operation
After RF gain is adjusted for a certain time, the just focus is adjusted.
After end, RF gain adjustment is started again.

DDT step 4 operation
Focus gain is adjusted.

DDT step 5 operation
Track gain is adjusted.

DDT step 6 operation
On the 2-layer disc, the just focus adjustment and focus gain adjustment of layer 1 are done.
On CD, interrupt of SUB-Q is allowed, TOC is read/set, and mute is turned off.

SRVPlayTest( )
Continuous replay & jump mode



In the continuous replay mode, the current sector address is displayed on ErrDisplay 1.

In SRV Play Test ( ), key is input and number of TR jumps is specified as follows.

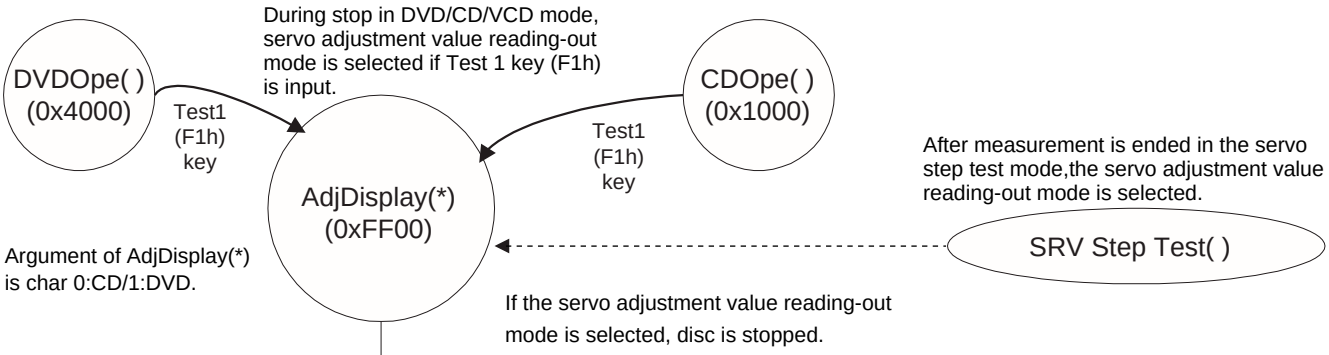
Key Name	(Code)	Jump Number of TRs
[1]	01h	-1
[4]	04h	-9
[7]	07h	-109
[Clear]	1Fh	-399
[2]	02h	-999
[5]	05h	-1000
[8]	08h	-6300
[Skip(-)]	2Dh	-14000

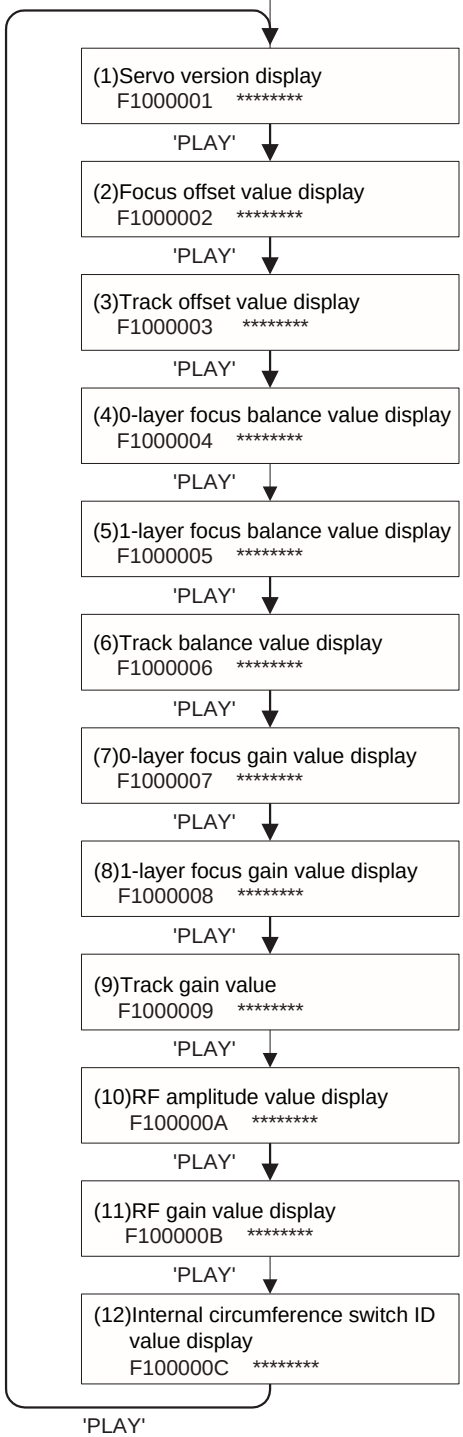
Key Name	(Code)	Jump Number of TRs
[3]	02h	+1
[6]	06h	+9
[9]	09h	+109
[Memory]	1Ch	+399
[Repeat]	35h	+999
[A-B]	36h	+1000
[Program]	1Eh	+6300
[Skip(+)]	2Eh	+14000

[Next replay] = Layer Jump

* Here, key allocation may be changed.
* Layer jump operation is not compensated except during 2-layer DVD test.

Servo adjustment value reading-out mode


DVDOpe( )
(0x4000)
Test1
(F1h)
key
During stop in DVD/CD/VCD mode, servo adjustment value reading-out mode is selected if Test 1 key (F1h) is input.
CDOpe( )
(0x1000)
Test1
(F1h)
key
After measurement is ended in the servo step test mode,the servo adjustment value reading-out mode is selected.
AdjDisplay(*)
(0xFF00)
SRV Step Test( )
Argument of AdjDisplay(*) is char 0:CD/1:DVD.
If the servo adjustment value reading-out mode is selected, disc is stopped.



In the servo adjustment value reading-out mode, the focus offset value is first displayed. Every input of PLAY key, the displayed data is changed as shown in the left.

After the servo step test, the internal circumference SW value (ID) display is not defined.

OSD adjustment value display

1. Press "FOh" key during disc replay. (Multiple press of S. PICTURE and STOP)
2. The following screen is displayed on OSD.
3. OSD display is turned off with "FOh" key.

1	2	3	4	5	6	7	8

9	10	11	12	13	14	15	16

17	18	19	20	21

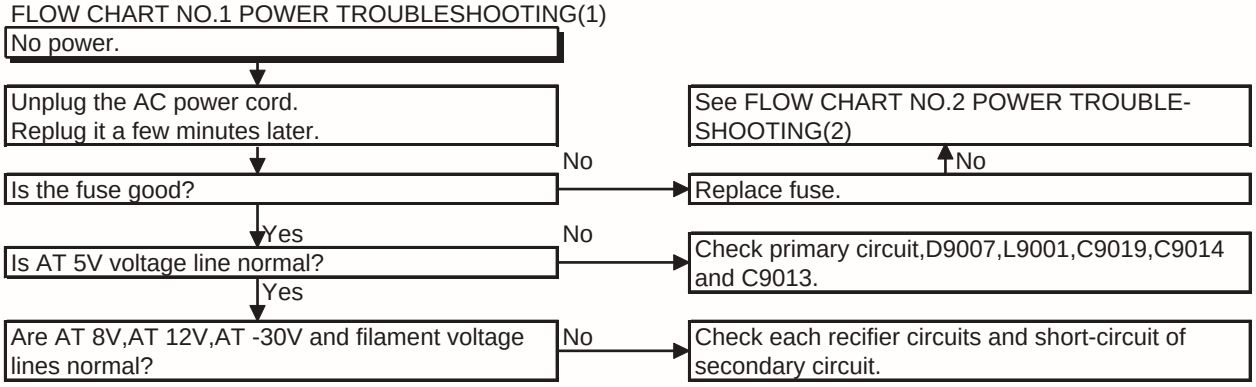
22	23	24	25	26

(1) 1, 2 ..... 0-layer focus gain
(2) 3, 4 ..... 1-layer focus gain
(3) 5, 6 ..... 0-layer focus gain
(4) 7, 8 ..... 1-layer focus gain
(5) 9, 10 ..... Track offset
(6) 11, 12 ..... Track gain
(7) 13, 14 ..... Track balance
(8) 15, 16 ..... RF gain
(9) 17, 18, 19, 20, 21 ..... Error rate average value
(10) 22, 23, 24, 25, 26 ..... Error rate maximum value

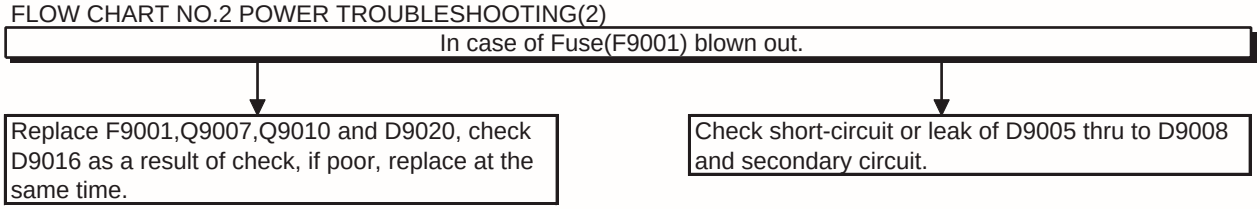
Hexadecimal data from (1) to (8).
Decimal data for (9) and (10).

11. TROUBLESHOOTING

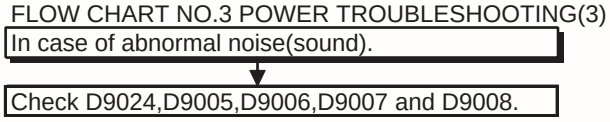
FLOW CHART NO.1 POWER TROUBLESHOOTING(1)



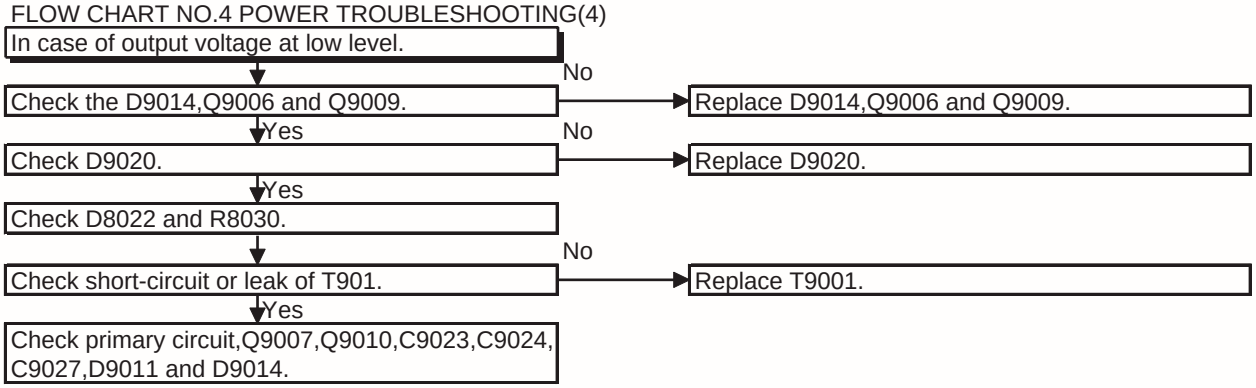
FLOW CHART NO.2 POWER TROUBLESHOOTING(2)


In case of Fuse(F9001) blown out.
Replace F9001,Q9007,Q9010 and D9020, check D9016 as a result of check, if poor, replace at the same time.
Check short-circuit or leak of D9005 thru to D9008 and secondary circuit.

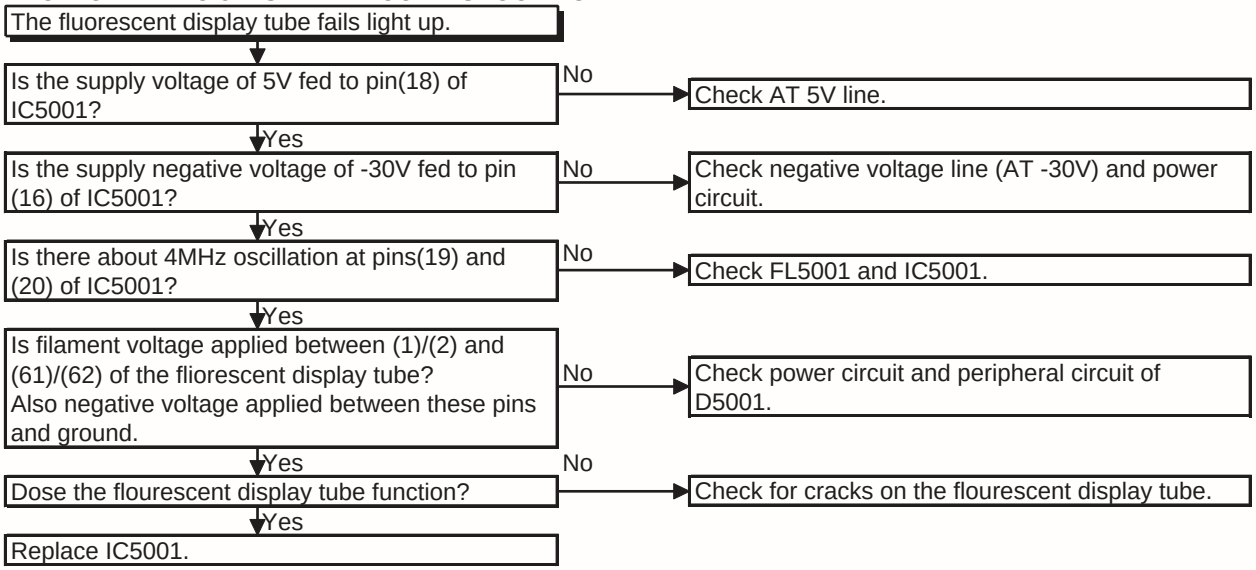
FLOW CHART NO.3 POWER TROUBLESHOOTING(3)



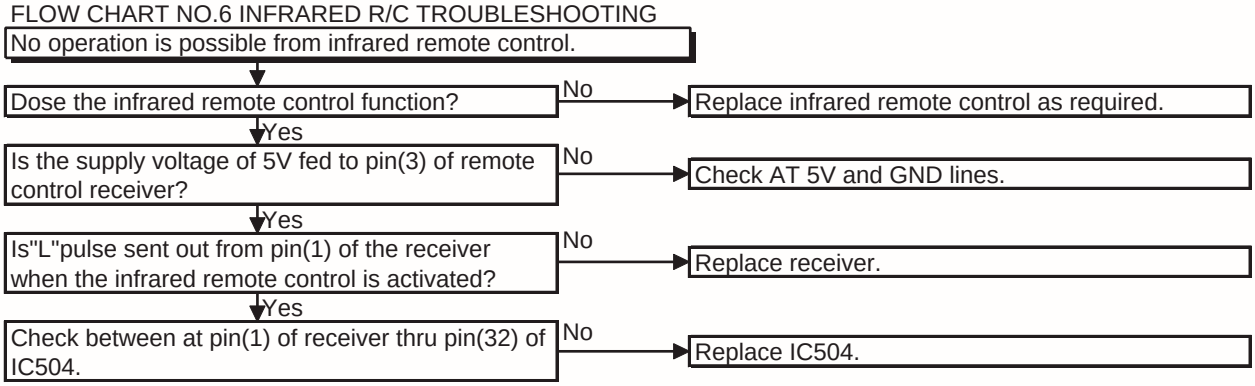
FLOW CHART NO.4 POWER TROUBLESHOOTING(4)



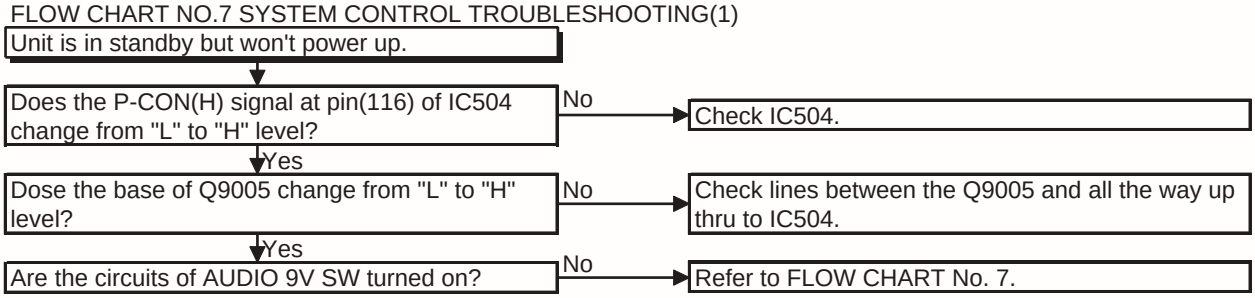
FLOW CHART NO.5 DISPLAY TROUBLESHOOTING


The fluorescent display tube fails light up.
Is the supply voltage of 5V fed to pin(18) of IC5001?
No
Check AT 5V line.
Yes
Is the supply negative voltage of -30V fed to pin (16) of IC5001?
No
Check negative voltage line (AT -30V) and power circuit.
Yes
Is there about 4MHz oscillation at pins(19) and (20) of IC5001?
No
Check FL5001 and IC5001.
Yes
Is filament voltage applied between (1)/(2) and (61)/(62) of the fliorescent display tube?
Also negative voltage applied between these pins and ground.
No
Check power circuit and peripheral circuit of D5001.
Yes
Dose the flourescent display tube function?
No
Check for cracks on the flourescent display tube.
Yes
Replace IC5001.

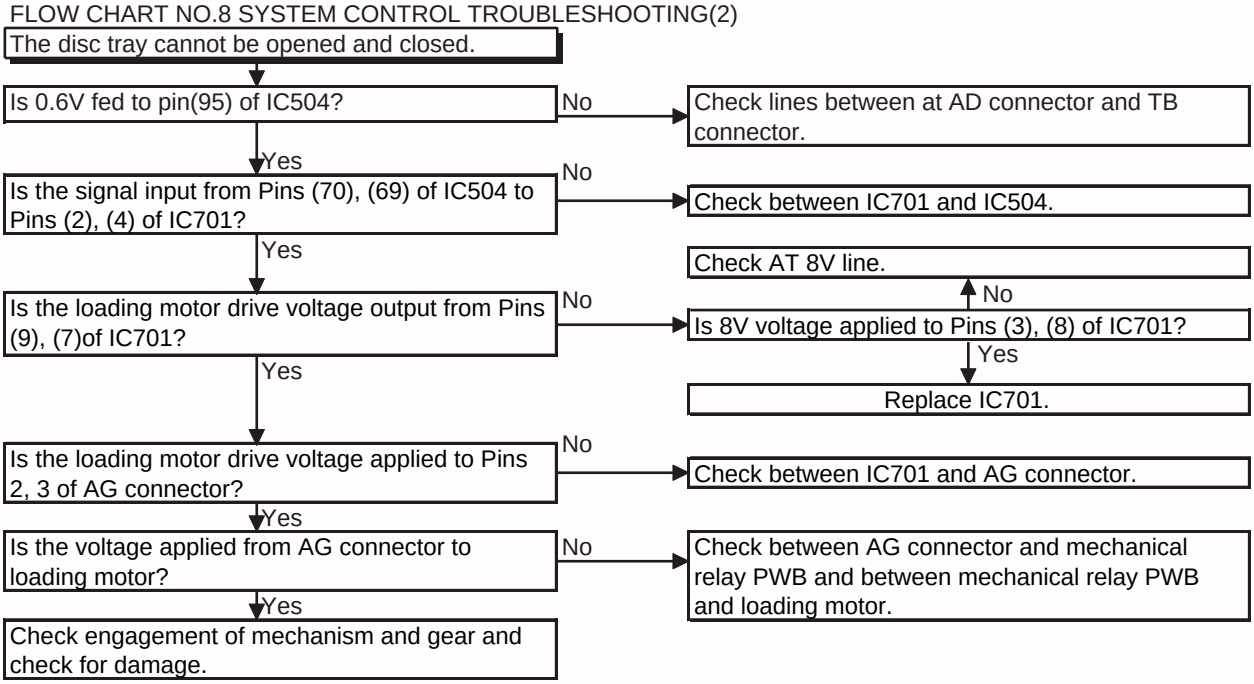
FLOW CHART NO.6 INFRARED R/C TROUBLESHOOTING


No operation is possible from infrared remote control.
Dose the infrared remote control function?
No
Replace infrared remote control as required.
Yes
Is the supply voltage of 5V fed to pin(3) of remote control receiver?
No
Check AT 5V and GND lines.
Yes
Is"L"pulse sent out from pin(1) of the receiver when the infrared remote control is activated?
No
Replace receiver.
Yes
Check between at pin(1) of receiver thru pin(32) of IC504.
No
Replace IC504.

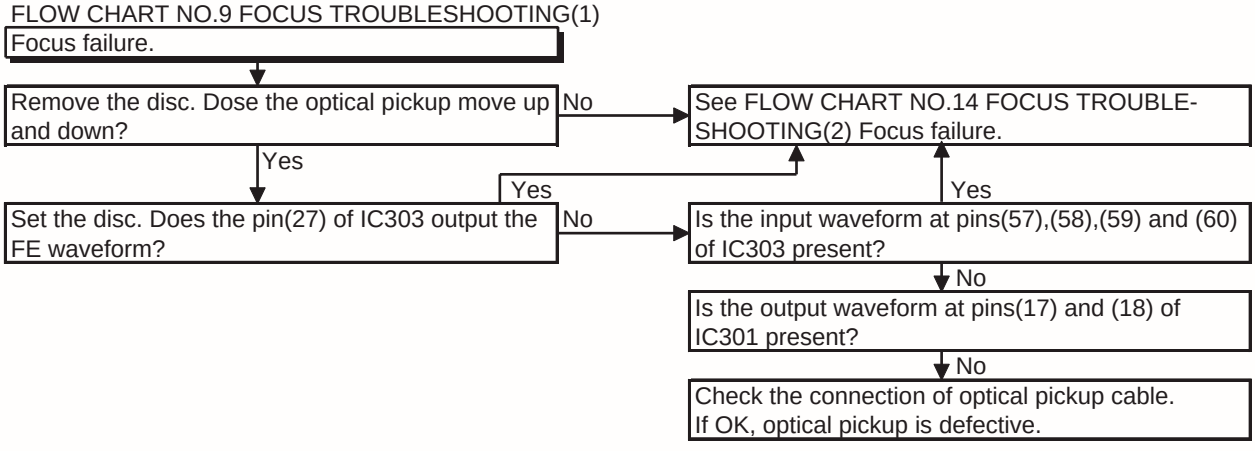
FLOW CHART NO.7 SYSTEM CONTROL TROUBLESHOOTING(1)


Unit is in standby but won't power up.
Does the P-CON(H) signal at pin(116) of IC504 change from "L" to "H" level?
No
Check IC504.
Yes
Dose the base of Q9005 change from "L" to "H" level?
No
Check lines between the Q9005 and all the way up thru to IC504.
Yes
Are the circuits of AUDIO 9V SW turned on?
No
Refer to FLOW CHART No. 7.

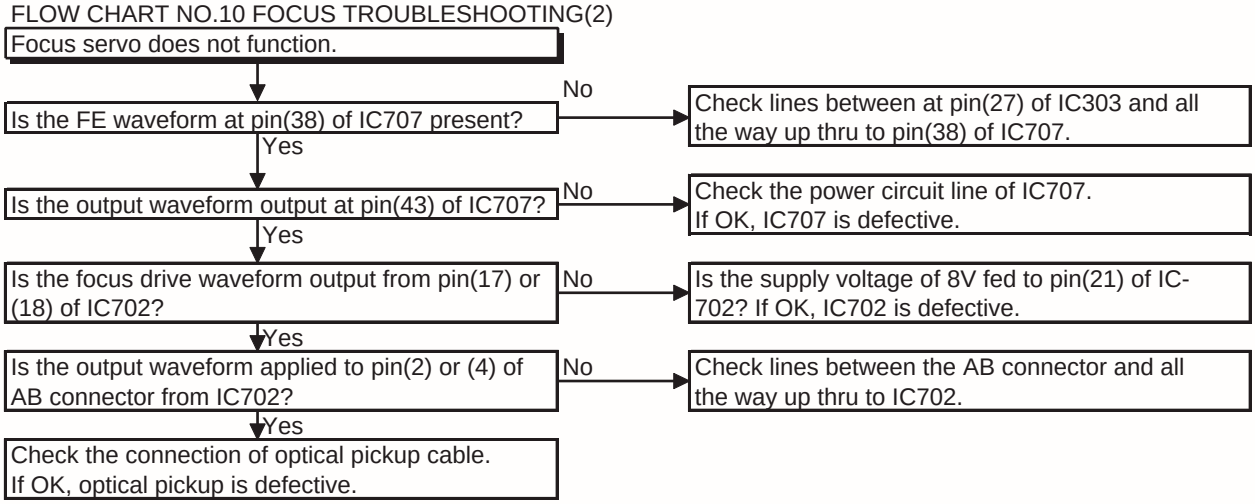
FLOW CHART NO.8 SYSTEM CONTROL TROUBLESHOOTING(2)


The disc tray cannot be opened and closed.
Is 0.6V fed to pin(95) of IC504?
No
Check lines between at AD connector and TB connector.
Yes
Is the signal input from Pins (70), (69) of IC504 to Pins (2), (4) of IC701?
No
Check between IC701 and IC504.
Yes
Check AT 8V line.
Is the loading motor drive voltage output from Pins (9), (7)of IC701?
No
Is 8V voltage applied to Pins (3), (8) of IC701?
Yes
Replace IC701.
Yes
Is the loading motor drive voltage applied to Pins 2, 3 of AG connector?
No
Check between IC701 and AG connector.
Yes
Is the voltage applied from AG connector to loading motor?
No
Check between AG connector and mechanical relay PWB and between mechanical relay PWB and loading motor.
Yes
Check engagement of mechanism and gear and check for damage.

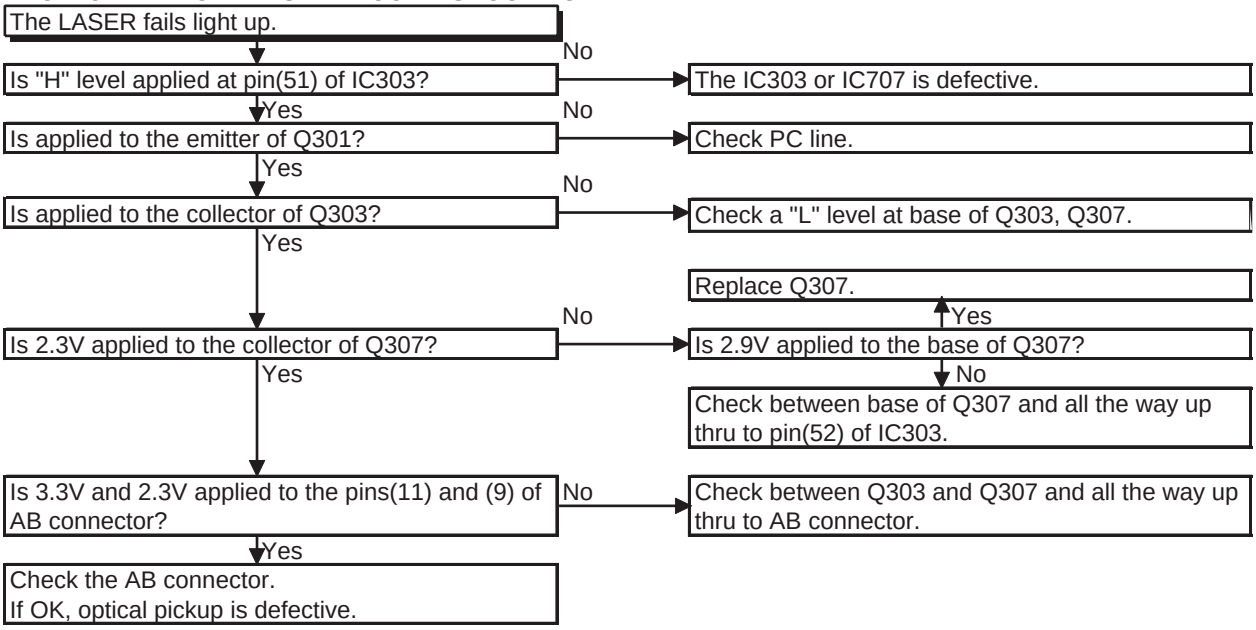
FLOW CHART NO.9 FOCUS TROUBLESHOOTING(1)

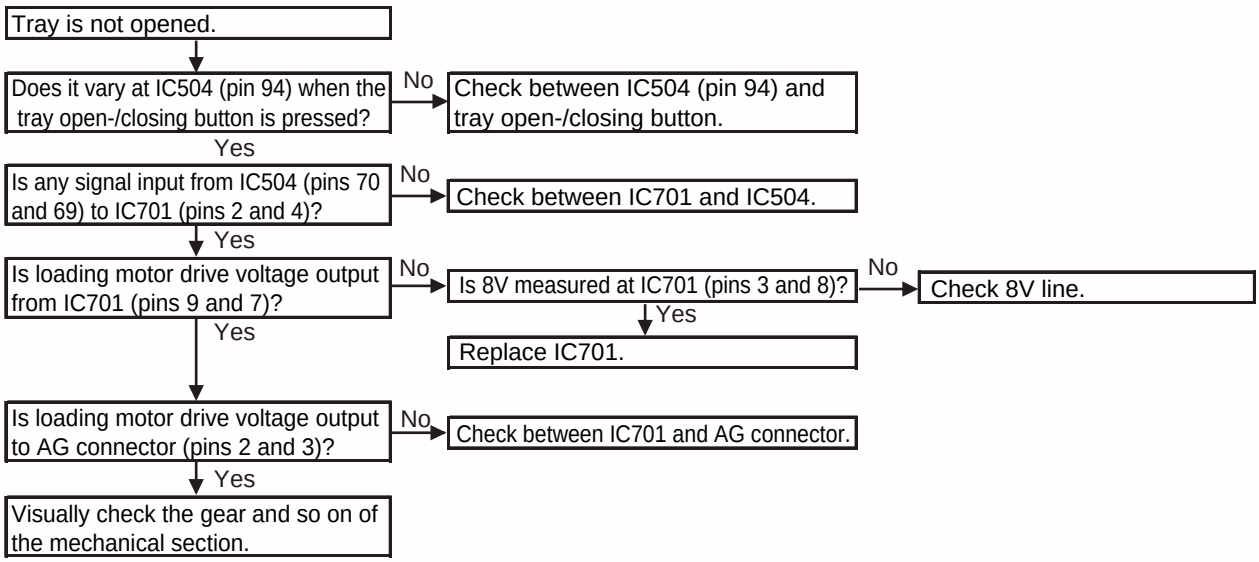

Focus failure.
Remove the disc. Dose the optical pickup move up and down?
No
See FLOW CHART NO.14 FOCUS TROUBLE-SHOOTING(2) Focus failure.
Yes
Yes
Yes
Set the disc. Does the pin(27) of IC303 output the FE waveform?
No
Is the input waveform at pins(57),(58),(59) and (60) of IC303 present?
No
Is the output waveform at pins(17) and (18) of IC301 present?
No
Check the connection of optical pickup cable.
If OK, optical pickup is defective.

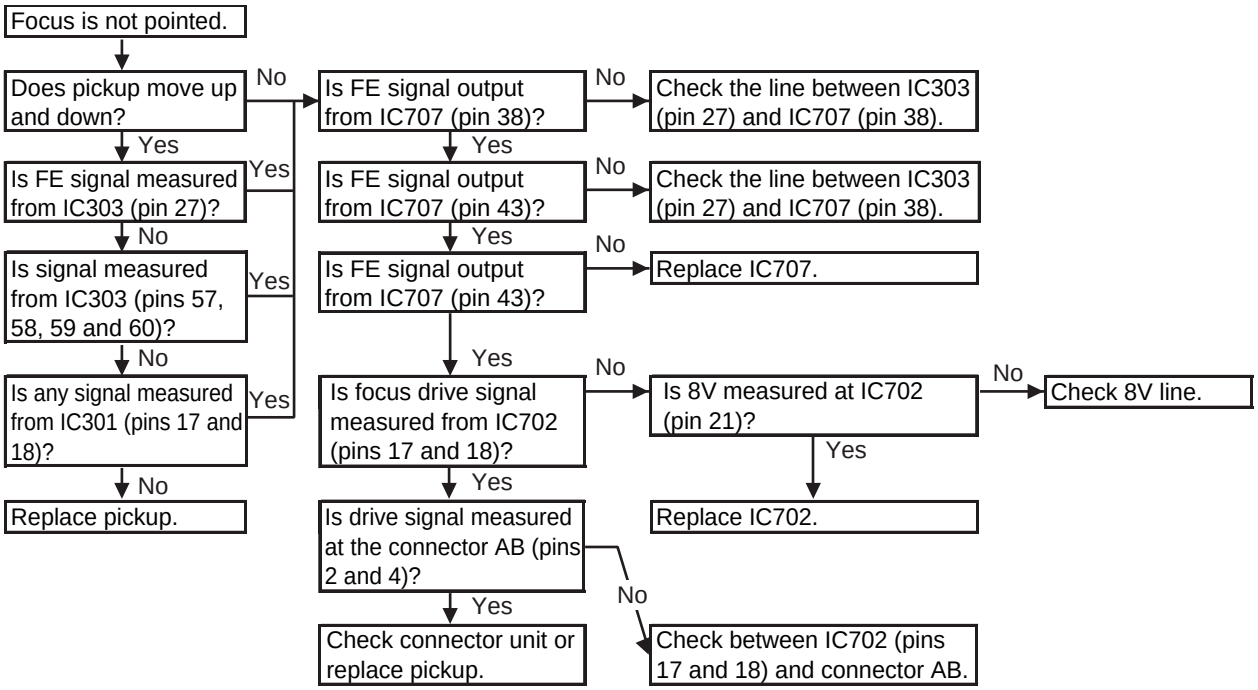
FLOW CHART NO.10 FOCUS TROUBLESHOOTING(2)

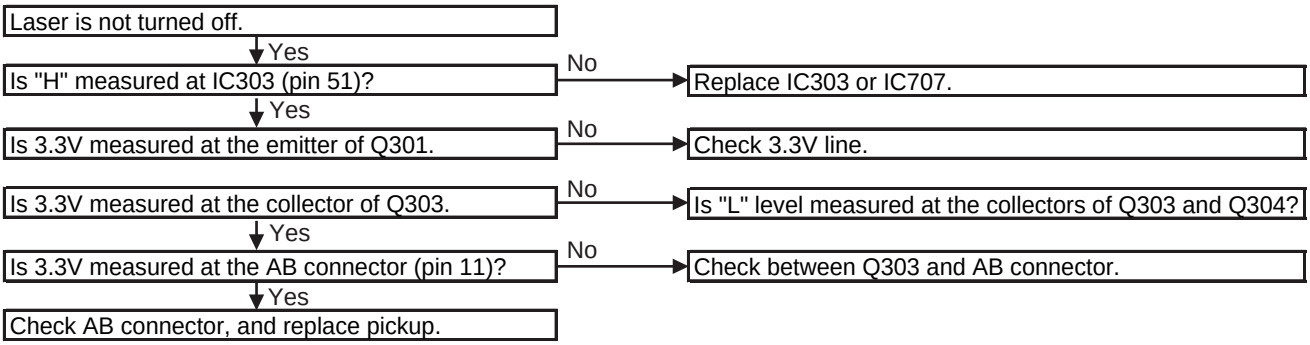

Focus servo does not function.
Is the FE waveform at pin(38) of IC707 present?
No
Check lines between at pin(27) of IC303 and all the way up thru to pin(38) of IC707.
Yes
Is the output waveform output at pin(43) of IC707?
No
Check the power circuit line of IC707. If OK, IC707 is defective.
Yes
Is the focus drive waveform output from pin(17) or (18) of IC702?
No
Is the supply voltage of 8V fed to pin(21) of IC-702? If OK, IC702 is defective.
Yes
Is the output waveform applied to pin(2) or (4) of AB connector from IC702?
No
Check lines between the AB connector and all the way up thru to IC702.
Yes
Check the connection of optical pickup cable. If OK, optical pickup is defective.

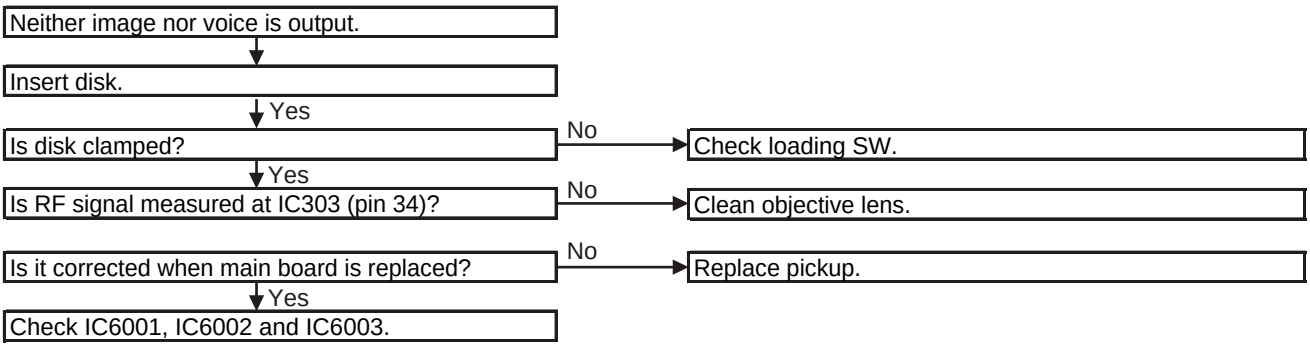
FLOW CHART NO.11 LASER TROUBLESHOOTING


The LASER fails light up.
Is "H" level applied at pin(51) of IC303?
No
The IC303 or IC707 is defective.
Yes
Is applied to the emitter of Q301?
No
Check PC line.
Yes
Is applied to the collector of Q303?
No
Check a "L" level at base of Q303, Q307.
Yes
Replace Q307.
Yes
Is 2.3V applied to the collector of Q307?
No
Is 2.9V applied to the base of Q307?
Yes
No
Check between base of Q307 and all the way up thru to pin(52) of IC303.
Is 3.3V and 2.3V applied to the pins(11) and (9) of AB connector?
No
Check between Q303 and Q307 and all the way up thru to AB connector.
Yes
Check the AB connector. If OK, optical pickup is defective.

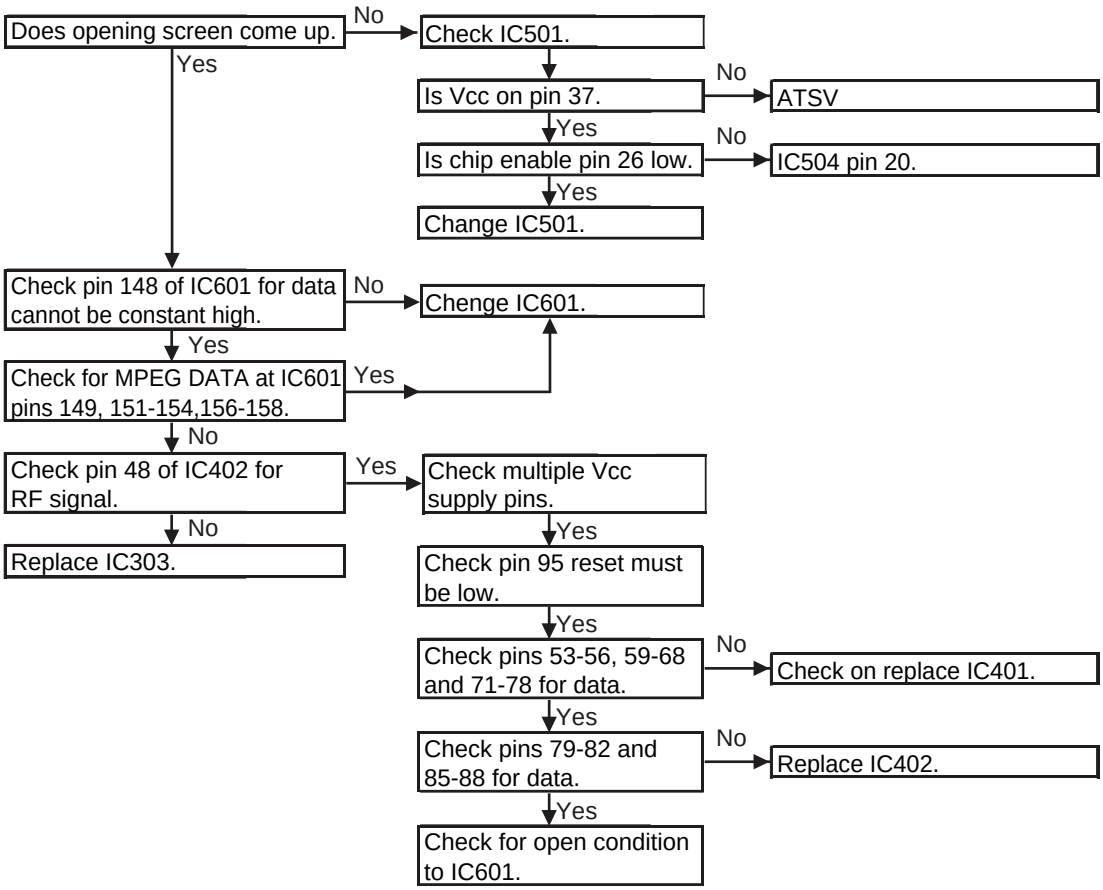

Tray is not opened.
Does it vary at IC504 (pin 94) when the tray open-/closing button is pressed?
No
Check between IC504 (pin 94) and tray open-/closing button.
Yes
Is any signal input from IC504 (pins 70 and 69) to IC701 (pins 2 and 4)?
No
Check between IC701 and IC504.
Yes
Is loading motor drive voltage output from IC701 (pins 9 and 7)?
No
Is 8V measured at IC701 (pins 3 and 8)?
No
Check 8V line.
Yes
Replace IC701.
Yes
Is loading motor drive voltage output to AG connector (pins 2 and 3)?
No
Check between IC701 and AG connector.
Yes
Visually check the gear and so on of the mechanical section.


Focus is not pointed.
Does pickup move up and down?
No
Yes
Is FE signal measured from IC303 (pin 27)?
Yes
No
Is signal measured from IC303 (pins 57, 58, 59 and 60)?
Yes
No
Is any signal measured from IC301 (pins 17 and 18)?
Yes
No
Replace pickup.
Is FE signal output from IC707 (pin 38)?
No
Yes
Check the line between IC303 (pin 27) and IC707 (pin 38).
Is FE signal output from IC707 (pin 43)?
No
Yes
Check the line between IC303 (pin 27) and IC707 (pin 38).
Is FE signal output from IC707 (pin 43)?
No
Yes
Replace IC707.
Is focus drive signal measured from IC702 (pins 17 and 18)?
No
Yes
Is 8V measured at IC702 (pin 21)?
No
Check 8V line.
Yes
Replace IC702.
Is drive signal measured at the connector AB (pins 2 and 4)?
No
Yes
Check connector unit or replace pickup.
Check between IC702 (pins 17 and 18) and connector AB.

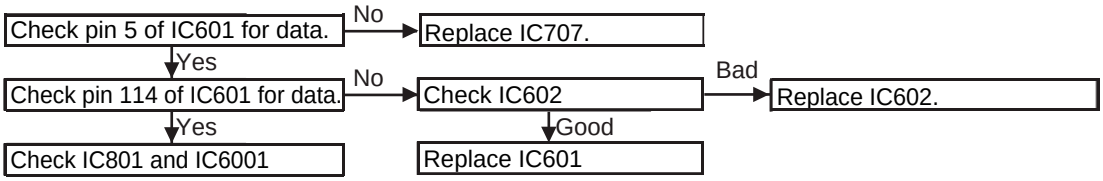

Laser is not turned off.
Yes
Is "H" measured at IC303 (pin 51)?
No
Replace IC303 or IC707.
Yes
Is 3.3V measured at the emitter of Q301.
No
Check 3.3V line.
Is 3.3V measured at the collector of Q303.
No
Is "L" level measured at the collectors of Q303 and Q304?
Yes
Is 3.3V measured at the AB connector (pin 11)?
No
Check between Q303 and AB connector.
Yes
Check AB connector, and replace pickup.


Neither image nor voice is output.
Insert disk.
Yes
Is disk clamped?
No
Check loading SW.
Yes
Is RF signal measured at IC303 (pin 34)?
No
Clean objective lens.
Is it corrected when main board is replaced?
No
Replace pickup.
Yes
Check IC6001, IC6002 and IC6003.

NO DVD VIDEO3 AND AUDIO BUT CD AUDIO OK



GOOD DVD AUDIO AND NO CD AUDIO



12. IC FUNCTION LIST

12-1. IC301 IX1461GE
RF PRE AMP.

Pin No.	Terminal name	I/O	Operation function
1	EIN	I	RF signal input. Input of RF signal output of optical pickup.
2	GND1	–	Ground
3	S/Dsel	I	Single layer/dual layer selection signal input.
4	AIN	I	RF signal input. Input of RF signal output of optical pickup.
5	BIN	I	RF signal input. Input of RF signal output of optical pickup.
6	CIN	I	RF signal input. Input of RF signal output of optical pickup.
7	DIN	I	RF signal input. Input of RF signal output of optical pickup.
8	VrefIN	I	Reference voltage input. (2.1V)
9	FIN	I	RF signal input. Input of RF signal output of optical pickup.
10	GAINsel1	I	Amp gain selection input 1.
11	VCC1	–	Power terminal. (5.0V)
12	GAINsel2	I	Amp gain selection input 2.
13	FOUT	O	RF signal output. Input RF signal is current-voltage-converted and output.
14	EOUT	O	RF signal output. Input RF signal is current-voltage-converted and output.
15	DOUT	O	RF signal output. Input RF signal is current-voltage-converted and output.
16	COUT	O	RF signal output. Input RF signal is current-voltage-converted and output.
17	BOUT	O	RF signal output. Input RF signal is current-voltage-converted and output.
18	AOUT	O	RF signal output. Input RF signal is current-voltage-converted and output.
19	VCC2	–	Power terminal. (5.0V)
20	RFPOUT	O	Data read signal output. The same phase as MIXIN.
21	RFNOUT	O	Data read signal output. Reverse phase with respect to MIXIN.
22	MIXIN	I	Data read signal input.
23	MIXOUT	O	Data read signal output.
24	GND2	–	Ground

12-1-1. Mode selection table

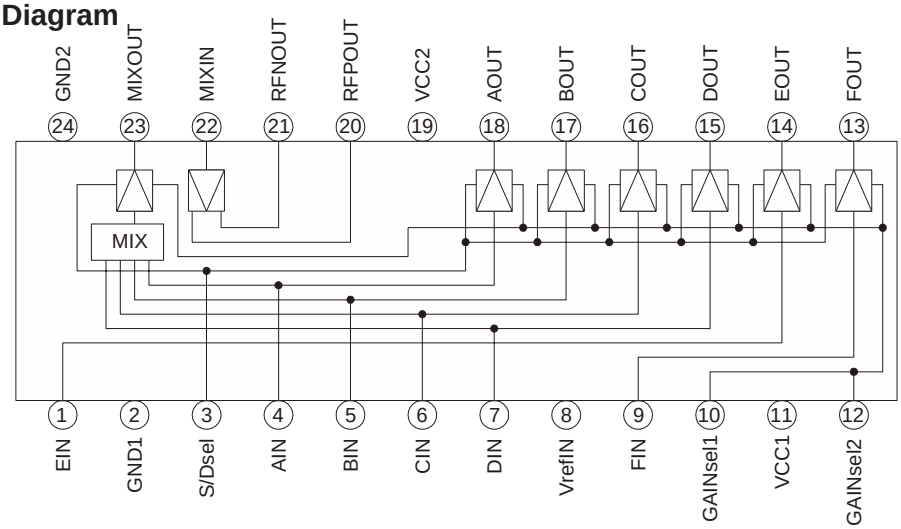
Single layer/dual layer selection

Layer	S/DSEL (Terminal 3)	Amp gain
Single	L, OPEN	0dB
Dual	H	+10dB

Amp. gain selection

GAINsel1 (Terminal 10)	GAINsel2 (Terminal 12)	Amp gain
L	L	+6dB
H, OPEN	L	-2dB
L	H, OPEN	+2dB
H, OPEN	H, OPEN	-6dB

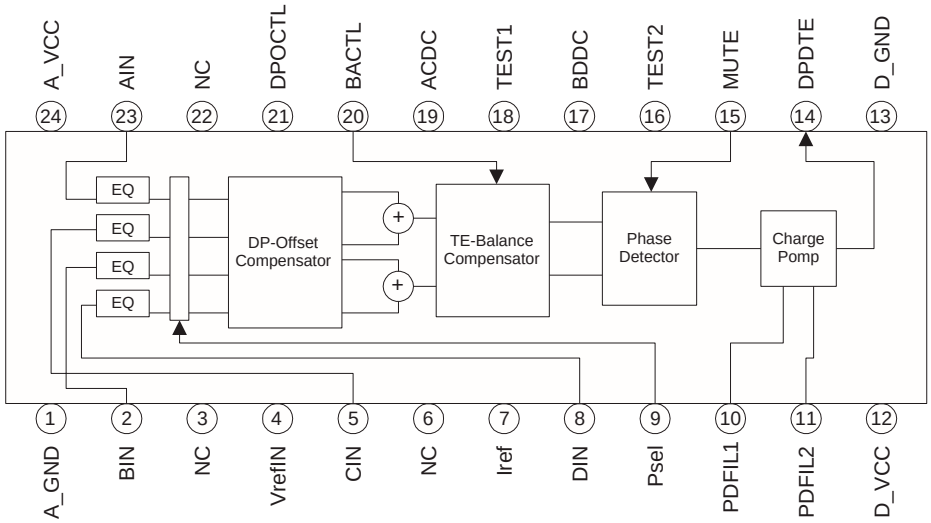
12-1-2. Block Diagram



12-2. IC302 IX1463GE
PHASE DIFFERENCE TRACKING ERROR SIGNAL GENERATION CIRCUIT

Pin No.	Terminal name	I/O	Operation function
1	A_GND	–	Ground
2	BIN	I	4-division detector B input.
3	NC	–	–
4	VrefIN	I	Reference voltage input.
5	CIN	I	4-division detector C input.
6	NC	–	–
7	Iref	I	Source setting current input for phase difference current conversion.
8	DIN	I	4-division detector D input.
9	Psel	I	Phase difference signal offset compensation correction polarity selection input. (80k Ω pull up)
10	PDFIL1	O	Phase difference current voltage conversion time constant setting external capacity.
11	PDFIL2	O	Phase difference current voltage conversion time constant setting external capacity.
12	D_VCC	–	Power (+5V)
13	D_GND	–	Ground
14	DPDTE	O	Tracking error signal output.
15	MUTE	I	Mute control input. (60k Ω pull down)
16	TEST2	–	Test Terminal.
17	BDDC	O	BD channel HPF time constant setting external capacity.
18	TEST1	–	Test terminal.
19	ACDC	O	AC channel HPF time constant setting external capacity.
20	BACTL	I	Tracking error balance control input.
21	DPOCTL	I	Phase difference signal offset compensation control input. (Open base)
22	NC	–	–
23	AIN	I	4-division detector B input.
24	A_VCC	–	Power (+5V)

12-2-1. Block Diagram



12-3. IC303 IX1462GE
RF SIGNAL PROCESSING

Pin No.	Terminal name	I/O	Operation function
1	TE BAL	I	Control input to change the sub-beam subtraction ratio in case of 3-beam system tracking error (TE) signal generation.
2	SBIN	I	Sub-beam addition amp. reverse input.
3	SBOUT	O	Sub-beam addition amp. output.
4	3BTE	O	3-beam TE signal intermediate output.
5	3BIN	I	3-beam TE level adjusting amp. reverse input.
6	3BOUT	O	3-beam TE level adjusting amp. output.
7	NC	–	–
8	DPDTE	I	Input of DPD system TE signal.
9	GND1	–	Servo system ground.
10	RPDetB	O	RF ripple detector RF bottom hold external capacity.
11	DetSR	O	RF ripple detector response rate setting resistance.
12	RPDetP	O	RF ripple detector RF peak hold external capacity.
13	VCC2	–	Power
14	ADJ.FIL	O	Filter external capacity for DVD-EQ-time constant compensation.
15	MCK	I	Clock input for DVD-EQ-time constant compensation.
16	GND2	–	Ground
17	2Vref FIL	O	Reference voltage smoothing external capacity.
18	2Vref	O	Reference voltage x2 output.
19	Vref FIL	O	Reference voltage smoothing external capacity.
20	Vref	O	Reference voltage output.
21	TEOUT	O	TE output after DPD/3B selection.
22	NC	–	–
23	PRE FIL	O	RF prefilter output.
24	NC	–	–
25	DVDGD	I	DVD-EQ group delay characteristics control input.
26	FEIN	I	Focus error (FE) signal output amp. reverse input.
27	FEOUT	O	FE output.
28	FWR FIL	O	Filter external capacity to DVD-WV detection signal.
29	RFcen	O	Amplitude center voltage output of RF ripple signal.
30	RFRPOUT	O	RF ripple signal output.
31	RFR FIL	O	RFRP signal filter external capacity.
32	GND3	–	RF system ground.
33	RPsel	I	Control input in case of selection of DVD-WV detection signal for RFRPOUT.
34	RF DVDOUT	O	EQ output of DVD.
35	RFcenB	O	RFRP center level detection. RFRP bottom hold external capacity.
36	RFcenP	O	RFRP center level detection. RFRP peak hold external capacitor.
37	VCC4	–	VCC for reference voltage.
38	DPD/3Bsel	I	Control input to select DPD or 3B for TE signal. H:3B L:DPD
39	RF CDOUT	O	CD-EQ output.
40	CDTime	I	CD-EQ curve frequency adjustment input.
41	DVDTime	I	DVD-EQ curve frequency adjustment input.
42	CDEQ	I	CD-EQ curve peak gain adjustment input.
43	DVD EQ	I	DVD-EQ curve peak gain adjustment input.
44	SQsel	I	CD-EQ x1/x4 linear speed selection input. H: x1 speed L: x4 speed.

Pin No.	Terminal name	I/O	Operation function
45	EQIN	I	DVD/CD-EQ input.
46	EQOUT	O	Output after passing of RFNIN and RFPIN VCA.
47	DVDsel	I	DVD/CD selection control input. H:CD L: DVD (PNP open space)
48	RFGain	I	RF signal VCA control input.
49	VCC3	–	RF system VCC.
50	MDIN	I	Laser diode APC monitor input.
51	LDC	I	LD ON/OFF control input. H:ON, L:OFF
52	LDOUT	O	LD external current driver control output.
53	LDPsel	I	APC control polarity selection input. H: Positive polarity L: Negative polarity.
54	RFPIN	I	RF signal nonreverse input from PU.
55	RFNIN	I	RF signal reverse input from PU.
56	VCC1	–	Servo system VCC.
57	AIN	I	Main beam 4-division detector A input for focus error (FE) generation.
58	BIN	I	Main beam 4-division detector B input for focus error (FE) generation.
59	CIN	I	Main beam 4-division detector C input for focus error (FE) generation.
60	DIN	I	Main beam 4-division detector D input for focus error (FE) generation.
61	VrefIN	I	2.1V reference voltage potential input.
62	EIN	I	Sub-bean E input.
63	FIN	I	Sub-bean F input.
64	S/Dsel	I	Single/double layer system selection input. H: Double layer, L: Single layer

12-4. IC707 IX1473GE
SERVO PROCCESSOR

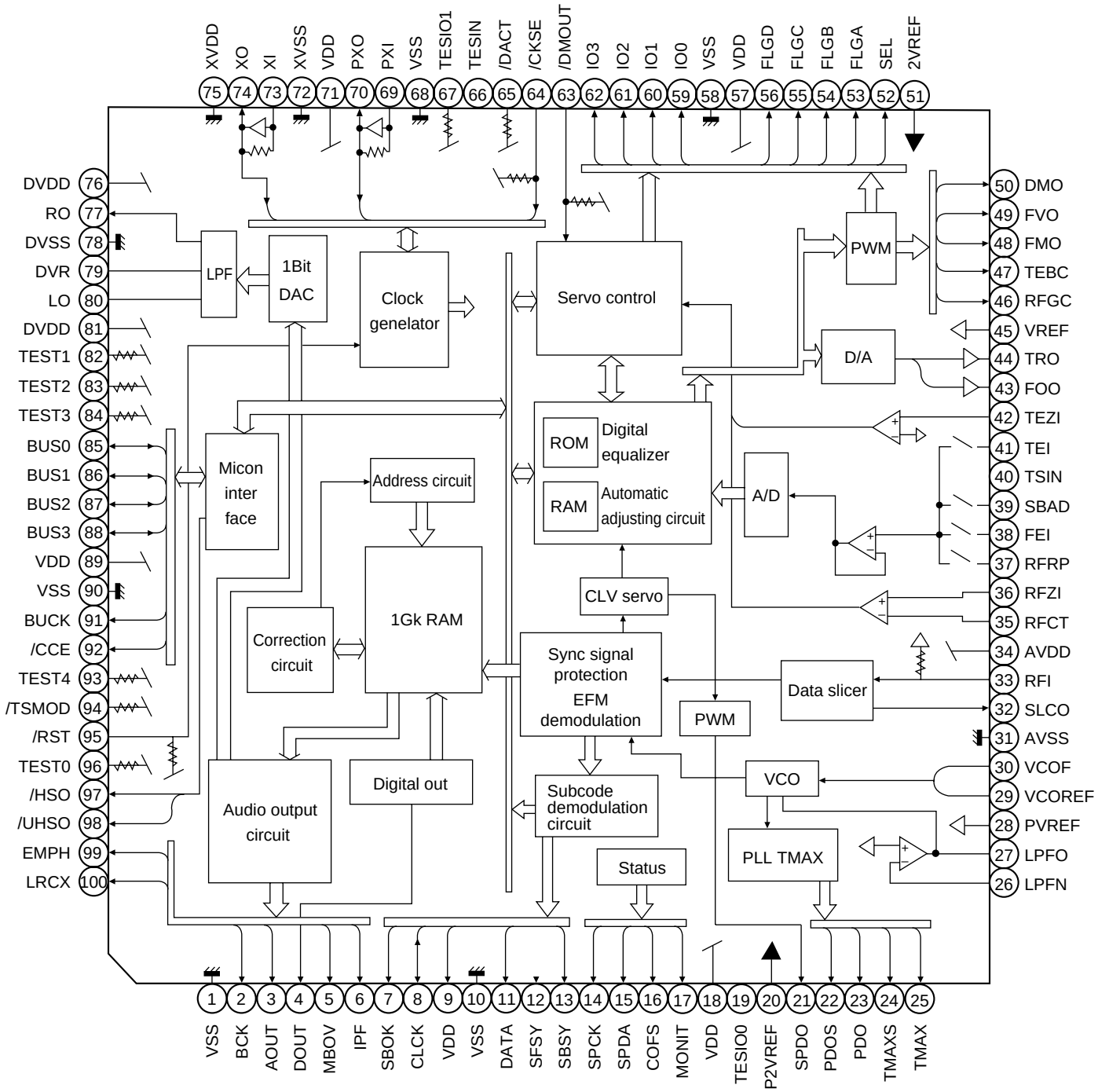
Pin No.	Terminal name	I/O	Operation function	Remarks
1	VSS	–	Digital ground terminal.	
2	BCK	O	Bit clock (1.4122MHz) output terminal.	
3	AOUT	O	Audio data output terminal.	
4	DOUT	O	Digital out output terminal.	
5	MBOV	O	Buffer memory over signal output terminal. Over: “H”	
6	IPF	O	Correction flag output terminal. When correction disable symbol is given if AOUT output is C2 correction: “H”.	
7	SBOK	O	Sub-code Q data CRCC judgment result output terminal. Judgment result OK: “H”.	
8	CLCK	I/O	Sub-code P to W data read clock output/input terminal. Selectable with command bit.	
9	VDD	–	Digital + power terminal	
10	VSS	–	Digital ground terminal	
11	DATA	O	Sub code P-W data output terminal.	
12	SFSY	O	Playback system frame sync signal output terminal.	
13	SBSY	O	Subcode block sync output terminal. When subcode sync is detected, S1 position: “H”.	
14	SPCK	O	Processor status signal read clock (176.4 kHz) output terminal.	
15	SPDA	O	Processor status signal output terminal.	
16	COFS	O	Correction system frame clock (7.35 kHz) output terminal.	
17	MONIT	O	LSI internal signal monitor terminal. DSP internal flag and PLL system clock can be monitored with microcomputer command.	
18	VDD	–	Digital + power terminal.	

<table>
<tr><th>Pin No.</th><th>Terminal name</th><th>I/O</th><th>Operation function</th><th>Remarks</th></tr>
<tr><td>19</td><td>TESIO0</td><td>I</td><td>Test input/output terminal. Usually fixed to “L”.</td><td></td></tr>
<tr><td>20</td><td>P2VREF</td><td>–</td><td>PLL system 2VREF terminal.</td><td></td></tr>
<tr><td>21</td><td>SPDO</td><td>O</td><td>VCO center frequency shift terminal.</td><td></td></tr>
<tr><td>22</td><td>PDOS</td><td>O</td><td>EFM and PLCK signal phase error signal output terminal.
(To be used when x8 speed operation is used)</td><td></td></tr>
<tr><td>23</td><td>PDO</td><td>O</td><td>EFM and PLCK signal phase error signal output terminal.</td><td></td></tr>
<tr><td>24</td><td>TMAXS</td><td>O</td><td rowspan="2">TMAX detection result output terminal.
To be selected with command bit TMPS.
<table><tr><th>TMAX detection result</th><th>TMAXoutput</th></tr><tr><td>Longer than specific period</td><td>“P2VREFF”</td></tr><tr><td>Shorter than specific period</td><td>“VSS”</td></tr><tr><td>Within specified period</td><td>“HiZ”</td></tr></table></td><td rowspan="2"></td></tr>
<tr><td>25</td><td>TMAX</td><td>O</td></tr>
<tr><td>26</td><td>LPFN</td><td>I</td><td>Reverse input terminal for low pass filter amplifier.</td><td></td></tr>
<tr><td>27</td><td>LPFO</td><td>O</td><td>Output terminal for low pass filter amplifier.</td><td></td></tr>
<tr><td>28</td><td>PVREF</td><td>–</td><td>PLL system VREF terminal.</td><td></td></tr>
<tr><td>29</td><td>VCOREF</td><td>I</td><td>VCO center frequency reference level terminal.
To be fixed usually to “PVREF”.</td><td></td></tr>
<tr><td>30</td><td>VCOF</td><td>O</td><td>Filter terminal for VCO.</td><td></td></tr>
<tr><td>31</td><td>AVSS</td><td>–</td><td>Analog system ground terminal.</td><td></td></tr>
<tr><td>32</td><td>SLCO</td><td>O</td><td>Data slice level generation DAC output terminal.</td><td></td></tr>
<tr><td>33</td><td>RFI</td><td>I</td><td>RF signal input terminal.</td><td></td></tr>
<tr><td>34</td><td>AVDD</td><td>–</td><td>Analog system power terminal.</td><td></td></tr>
<tr><td>35</td><td>RFCT</td><td>I</td><td>RFRP signal center level input terminal.</td><td></td></tr>
<tr><td>36</td><td>RFZI</td><td>I</td><td>RFRP zero cross input terminal.</td><td></td></tr>
<tr><td>37</td><td>RFRP</td><td>I</td><td>RF ripple signal input terminal.</td><td></td></tr>
<tr><td>38</td><td>FEI</td><td>I</td><td>Focus error signal input terminal.</td><td></td></tr>
<tr><td>39</td><td>SBAD</td><td>I</td><td>Sub-beam addition signal input terminal.</td><td></td></tr>
<tr><td>40</td><td>TSIN</td><td>I</td><td>Test input terminal. To be fixed usually to “Vref”</td><td></td></tr>
<tr><td>41</td><td>TEI</td><td>I</td><td>Tracking error signal input terminal.
(Fetching when tracking servo is ON)</td><td></td></tr>
<tr><td>42</td><td>TEZI</td><td>I</td><td>Tracking error zero cross input terminal.</td><td></td></tr>
<tr><td>43</td><td>FOO</td><td>O</td><td>Focus equalizer output terminal.</td><td></td></tr>
<tr><td>44</td><td>TRO</td><td>O</td><td>Tracking equalizer output terminal.</td><td></td></tr>
<tr><td>45</td><td>VREF</td><td>–</td><td>Analog reference power terminal.</td><td></td></tr>
<tr><td>46</td><td>RFGC</td><td>O</td><td>RF amplitude adjustment control signal output terminal.
Output of 3-pole PWM signal. (PWM carrier = 88.2 kHz)</td><td></td></tr>
<tr><td>47</td><td>TEBC</td><td>O</td><td>Tracking balance control signal output terminal.
Output of 3-pole PWM signal. (PWM carrier = 88.2 kHz)</td><td></td></tr>
<tr><td>48</td><td>FMO</td><td>O</td><td>Feed equalizer output terminal.
Output of 3-pole PWM signal. (PWM carrier = 88.2 kHz)</td><td></td></tr>
<tr><td>49</td><td>FVO</td><td>O</td><td>Speed error signal or feed search EQ output terminal.
Output of 3-pole PWM signal. (PWM carrier = 88.2 kHz)</td><td></td></tr>
<tr><td>50</td><td>DMO</td><td>O</td><td>Disc equalizer output terminal.
Output of 3-pole PWM signal. (PWM carrier = DSP system 88.2kHz, to be synchronized with PXO)</td><td></td></tr>
<tr><td>51</td><td>2VREF</td><td>–</td><td></td><td></td></tr>
</table>

Pin No.	Terminal name	I/O	Operation function	Remarks
52	SEL	O		
53	FLGA	O		
54	FLGB	O		
55	FLGC	O		
56	FLGD	O		
57	VDD	–		
58	VSS	–		
59	IO0	I/O	General use I/O port.	
60	IO1		It is possible to select the input port and output port according to command.	
61	IO2		In case of input port the terminal state (H/L) can be read with the read command.	
62	IO3		In case of output port the terminal state (H/L/HiZ) can be controlled with the command.	
63	/DMOUT		Terminal to set the mode to output dual value PWM of feed equalizer from the IO0,1 terminal and to output the dual value PWM from disc equalizer of IO2,3 terminal “L” Active.	
64	/CKSE		X’tal selection terminal. When 16.9344 MHz: “H” When 33.8688 MHz: “L”	
65	/DACT		Test terminal.	
66	TESIN		Test input terminal.	
67	TESIO1		Test input/output terminal.	
68	VSS		Digital ground terminal.	
69	PXI		DSP system clock oscillation circuit input terminal.	
70	PXO		DSP system clock oscillation circuit output terminal.	
71	VDD		Digital + power terminal.	
72	XVSS		Ground terminal for system clock oscillation circuit.	
73	XI		System clock oscillation circuit input terminal.	
74	XO		System clock oscillation circuit output terminal.	
75	XVDD		Positive power terminal for system clock oscillation circuit.	
76	DVDD	–	D/A converting section power terminal.	
77	RO	O	R channel data forward rotation output terminal.	
78	DVSS	–	D/A converting section analog ground terminal.	
79	DVR	–	D/A converting section reference voltage terminal.	
80	LO	O	L channel data forward rotation output terminal.	
81	DVDD	–	D/A converting section power terminal.	
82	TEST1	I	Test terminal. To be opened usually.	Pull-up resistor built in.
83	TEST2	I	Test terminal. To be opened usually.	Pull-up resistor built in.
84	TEST3	I	Test terminal. To be opened usually.	Pull-up resistor built in.
85	BUS0	I/O	Microcomputer interface data input/output terminal.	Schmidt input CMOS port
86	BUS1	I/O		
87	BUS2	I/O		
88	BUS3	I/O		
89	VDD	–	Digital + power terminal.	

<table>
<tr><th>Pin No.</th><th>Terminal name</th><th>I/O</th><th>Operation function</th><th>Remarks</th></tr>
<tr><td>90</td><td>VSS</td><td>–</td><td>Digital ground terminal.</td><td></td></tr>
<tr><td>91</td><td>BUCK</td><td>I</td><td>Microcomputer interface clock input terminal.</td><td>Schmidt input</td></tr>
<tr><td>92</td><td>/CCE</td><td>I</td><td>Microcomputer interface chip enable signal input terminal.
BUS0 to 3 is active in “L” state.</td><td>Schmidt input</td></tr>
<tr><td>93</td><td>TEST4</td><td>I</td><td>Test terminal.
To be opened usually.</td><td>Pull-up resistor built in.</td></tr>
<tr><td>94</td><td>/TSMOD</td><td>I</td><td>Local test mode selection terminal.</td><td>Pull-up resistor built in.</td></tr>
<tr><td>95</td><td>/RST</td><td>I</td><td>Reset signal input terminal.
Reset state: “L”</td><td>Pull-up resistor built in.</td></tr>
<tr><td>96</td><td>TEST0</td><td>I</td><td>Test terminal.
To be opened usually.</td><td>Pull-up resistor built in.</td></tr>
<tr><td>97</td><td>/HSO</td><td>O</td><td rowspan="2">Playback speed mode flag output terminal.
<table><tr><th>/UHSO</th><th>/HSO</th><th>Playback speed</th></tr><tr><td>H</td><td>H</td><td>x1 speed playback</td></tr><tr><td>H</td><td>L</td><td>x2 speed playback</td></tr><tr><td>L</td><td>H</td><td>x4 speed playback</td></tr><tr><td>L</td><td>L</td><td>x8 speed playback</td></tr></table></td><td rowspan="2"></td></tr>
<tr><td>98</td><td>/UHSO</td><td>O</td></tr>
<tr><td>99</td><td>EMPH</td><td>O</td><td>Subcode Q data emphasis flag output terminal.
Emphasis ON: “H” OFF: “L”
Output polarity can be inverted by the command.</td><td></td></tr>
<tr><td>100</td><td>LRCK</td><td>O</td><td>Channel clock (44.1 kHz) output terminal.
L channel “L” R channel: “H”
Output polarity can be inverted by the command.</td><td></td></tr>
</table>

12-4-1. Block Diagram



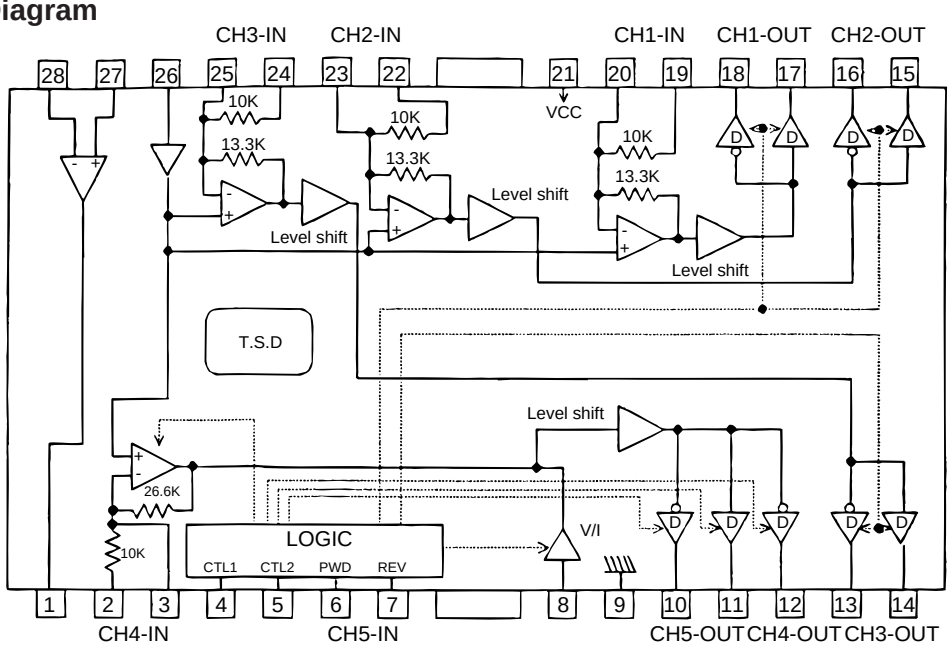
12-5. IC702 BA6796FP
MOTOR DRIVER

Pin No.	Terminal name	Operation function	Pin No.	Terminal name	Operation function
1	OPOUT	Ope amp. output terminal	15	CH2-OUT-	CH2 Negative output terminal
2	CH4-IN	CH4 Input terminal	16	CH2-OUT+	CH2 Positive output terminal
3	CH4-IN'	CH4 Gain adjustment input terminal	17	CH1-OUT-	CH1 Negative output terminal
4	CTL1	Contorol 1 input terminal	18	CH1-OUT+	CH1 Positive output terminal
5	CTL2	Contorol 2 input terminal	19	CH1-IN	CH1 Input terminal
6	FWD	Tray forward input terminal	20	CH1-IN'	CH1 Input terminal for gain adjustment
7	REV	Tray reverse input terminal	21	VCC	VCC
8	TRAY-IN	Tray input terminal	22	CH2-IN	CH2 Input terminal
9	GND	Sub-straight GND	23	CH2-IN'	CH2 Input terminal for gain adjustment
10	CH5-OUT-	Tray negative output terminal	24	CH3-IN	CH3 Input terminal
11	COM-OUT	Tray positive output terminal/CH4 negative output terminal	25	CH3-IN'	CH3 Input terminal for gain adjustment
12	CH4-OUT+	CH4 Positive output terminal	26	VREF-IN	Bias amp. input terminal
13	CH3-OUT+	CH3 Positive output terminal	27	OPIN+	Operational amplifier nonreverse input terminal
14	CH3-OUT-	CH3 Negative output terminal	28	OPIN-	Operational amplifier reverse input terminal

Note 1: Positive and negative output have polarity with respect to input. (An example: 19 pin input 'H': 18 pin output 'H')

Note 2: Tray positive output and tray negative output have polarity with respect to mode. (An example: 11 pin output 'H' in FORWARD mode)

12-5-1. Block Diagram



T.S.D ; Thermal shutdown
D; Drive buffer
Unit of resistance is [Ω].

12-5-2. Mode change table

CTL1 and CTL2

CTL1	CTL2	CH1	CH2	CH3	CH4	CH5
L	L	OFF				ON
L	H					
H	L	ON				OFF
H	H	OFF		ON	OFF	ON

For F and R (CH5 control, valid only when CH5 is ON)

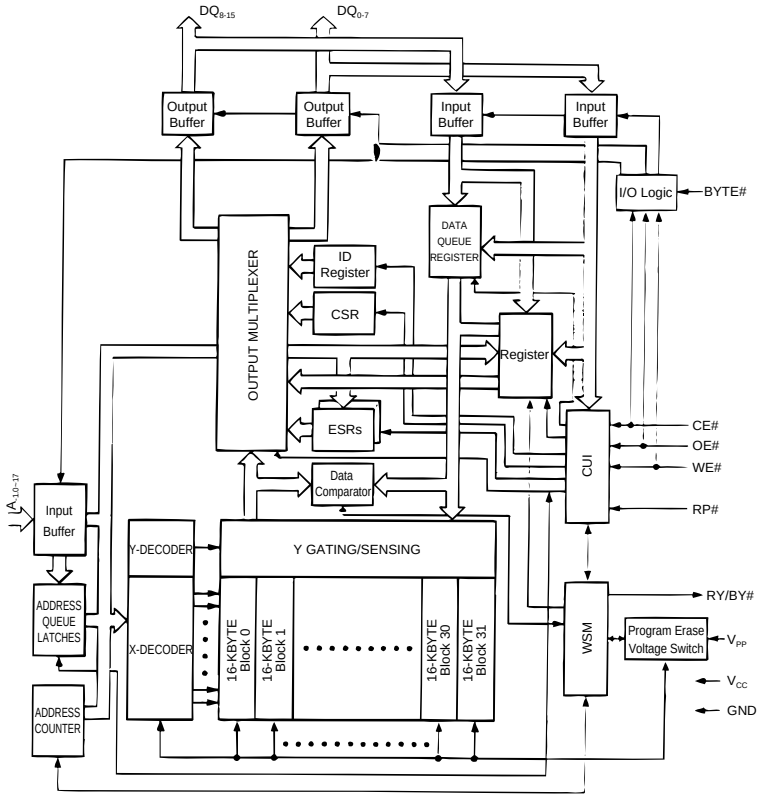
F	R	Output mode
L	L	High impedance
L	H	Reversing (reverse)
H	L	Forward rotation (forward)
H	H	Brake

Note: OFF state: Output has high impedance.

12-6. IC501 IX1502GE
FLASH

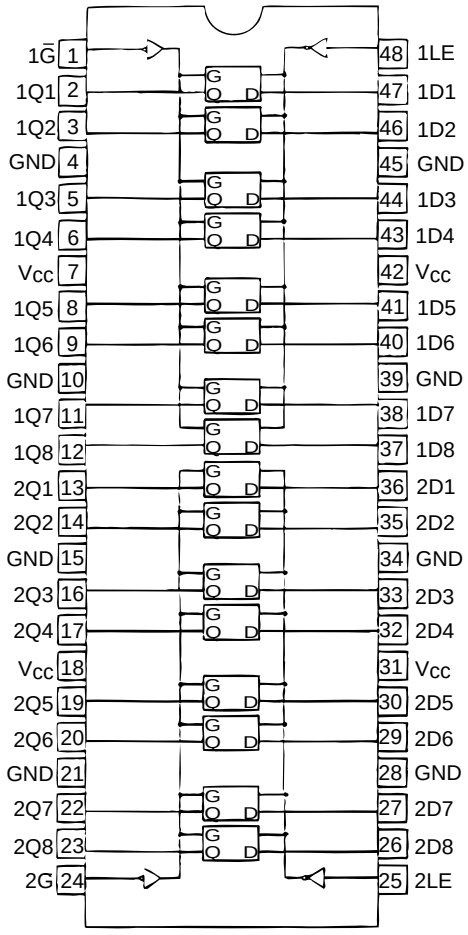
Symbol	Type	Name and function
DQ_{15}/A_{-1}	Input	Byte selection address: When the device is in the x8 mode, the low or high order byte is selected. It is not used in the x16 mode. (If BYTE# is high, DQ_{15}/A_{-1} input circuit does not operate.)
A_0-A_{12}	Input	Word selection address: Selection of one word of 16k byte block. These addresses are latched during data wiring operation.
A_{13}-A_{17}	Input	Block selection address: Selection of 1/32 erase block. These addresses are latched during data writing, erasing and lock block operation.
DQ_0-DQ_7	Input/Output	Low order byte data input/output: Command user interface writing cycle data and command input. Various data read memory identifier and status data output Chip nonselection or output disable: Float state
DQ_8-DQ_{15}	Input/Output	High order byte data input/output: The function is the same as that of low order byte data input/output. Operative only in x16 mode. x8 mode: Float state DQ_{15}/A_{-1} is address.
CE#	Input	Chip enable: Device control logic, input buffer, decoder and sense amp. are activated. Chip becomes active only when CE# is “Low”.
RP#	Input	Reset/Power down: If RP# is set to “Low”, the control circuit is initialized when power is turned on. Hence, the RP#pin is set to “Low”. When power is turned on or off or in case of fluctuation it is kept at “Low” so as to protect data from noise. When RP# is in “Low” state, the device is in deep power down state. 480 ns is required to recover from the deep power down state. If the RP# pin becomes “Low”, the whole chip operation is interrupted and reset. After recovery the device is set to array read state.
OE#	Input	Output enable: When OE# is set to “Low”, data is output from the DQ pin. When OE# is set to “High”, the DQ pin is set to float state.
WE#	Input	Write enable: Command user interface, data Q register and address Q latch access is controlled. In “Low” state WE# becomes active. At rise edge the address and data are fetched.
RY/BY#	Output	Ready/busy: The state of internal write state machine is output. In “Low” state it is indicated that the write state machine is in operation. If the write state machine waits for next operation instruction, erase is suspended or it is in deep power down state, the RY/BY# pin is in float state.
BYTE#	Input	Byte enable: When BYTE# is set to “Low”, the device is set to the x8 mode. At this time the DQ_8-DQ_{15} pin becomes float state. Address A_{-1} selects high order/low order byte. When BYTE# is “High”, the device is set to the x16 mode. The A_{-1} input circuit is disabled.
Vpp		Write/erase power supply: 5.0 ± 0.5V is applied during writing/erasing.
Vcc		Device power supply: 5.0 ± 0.5V
GND		Ground
NC		Nonconnection

12-6-1. Block Diagram



12-7. IC503 IX1479GE GATE ARRAY

12-7-1. Block Diagram



12-7-2. Mode change table

Inputs			Output Q
$\overline{G}$	LE	D	
H	X	X	Z
L	H	L	L
L	H	H	H
L	L	X	Q_0

H : High level
L : Low level
X : Immaterial
Z : High impedance
Q_0 : Level of Q before the indicated steady input conditions were established.

12-8. IC601 IX1475GE
VIDEO/AUDIO DECODER

Microcomputer interface terminal list

Pin No.	Pin name	Type	Direction	Function
Microcomputer interface				
22 24-26	HA[3:0]	I	I	Address bus input for microcomputer connection. Used for register access and so on
27	HWR# (HR/W#)	I	I	HTYPE = L It works as HR/W#(read/write) input terminal for connection to Motorola type microcomputer. HTYPE = H It works as HWR# (write) input terminal for connection to general purpose microcomputer.
29	HCS#	I	I	Chip select input for connection to microcomputer
30	HRD# (HDS#)	I	I	HTYPE = L It works as HDS#(data strobe) input terminal for connection to Motorola type microcomputer. HTYPE = H It works as HRD# (read) input terminal for connection to general purpose microcomputer.
31	HRDY	3-S	O	Bit stream input ready output terminal If the bit stream is input from microcomputer, the terminal is bored. For 3-state output, connect the pull-up resistor. HRDY = L Bit stream can not be input. HRDY = H The number of bytes which are set by CodBurstLen parameter can be transferred from the microcomputer. During the time from transfer start of the number of set bytes to transfer end, the terminal varies in 3 states.
32	HACK# (HWAIT#)	3-S	O	HTYPE = L It works as HACK# (acknowledge) output terminal for connection to Motorola type microcomputer. HTYPE = H It can be used as the weight terminal for connection to the general pur pose microcomputer. For 3-state output, connect the pull-up resistor.
34	HIRQ#	3-S	O	Interrupt request. If interrupt status register is read, interrupt is masked or device is reset, the signal is deasserted. For 3-state output, connect the pull-up resistor.
35	HWID	I	I	The bus width of the microcomputer interface If the device is worked as CD-G decoder or CD-DSP is connected, select the 8-bit bus mode. Fix it before power up. L=8bit bus mode H=16bit bus mode
36	HORD	I	I	When HWID is H (16-bit bus MODE), byte order is set. Setting is valid only when HWID is H. Fix it before power up. L=HD [15:8] is regarded as m.s. byte. (Motorola type) H=HD [7:0] is regarded as m.s. byte. (Intel type)
37	HTYPE	I	I	Bus type of microcomputer interface is set. Fix it before power up. L=Motorola type H=General purpose type
141	RESET#	I	I	RESET is input.
142	IDLE	3-S	O	It is output to indicate the idle state.

Microcomputer / CD·subcode interface terminal list

Pin No.	Pin name	Type	Direction	Function
Microcomputer interface / CD·subcode interface				
3	HD15 (CDCLK)	3-S (I)	I/O (I)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 15th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to input bit clock from DC-DSP.
4	HD14 (CDDAT)	3-S (I)	I/O (I)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 14th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to input the stream/PCM data from CD-DSP.
5	HD13 (CDFRM)	3-S (I)	I/O (I)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 13th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to input frame synchronous signal from CD-DSP.
6	HD12 (CDERR)	3-S (I)	I/O (I)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 12th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to input error signal to CD-DSP.
7	HD11 (SCCLK)	3-S (O)	I/O (O)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 11th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to output the subcode reading clock to the subcode interface of CD-DSP.
9	HD10 (SCDAT)	3-S (I)	I/O (I)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 10th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to input subcode data from subcode interface of CD-DSP.
10	HD9 (SCSYN)	3-S (I)	I/O (I)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 9th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to input the subcode synchronous signal from the subcode interface of CD-DSP.
11	HD8 (SCFRM)	3-S (I)	I/O (I)	When 16-bit bus width is selected, (HWID=low) It works as the microcomputer data bus of 9th bit. When 8-bit bus width is selected, (HWID=high) It works as the terminal to input the frame synchronous signal from the subcode interface of CD-DSP.
12 14-17 19-21	HD[7:0]	3-S	I/O	It works as the microcomputer bus of bits 7 thru 0.

General port terminal list

Pin No.	Pin name	Type	Direction	Function
General port				
2	GPSI	I	I	General purpose terminal.
122-123	GPAIO[1:0]	3-S	I/O	General input/output terminal. After resetting, it becomes the input direction.
159	GPSO	O	O	General output terminal.

PLL interface terminal list

Pin No.	Pin name	Type	Direction	Function
PLL interface				
126	GCLK1	I	I	Test terminal. Don't connect it.
128	XO	O	O	If quartz oscillator is connected to GCLK terminal, connect the other terminal of quartz oscillator to this pin.
129	GCLK	I	I	Master clock input terminal of device Input 27 MHz.
135, 137	PLLCFG[1:0]	I	I	PLL is set. Before power-up, fix it.
136	PLLCA	–	–	External capacitor terminal for PLL.

Video/OSD interface terminal list

Pin No.	Pin name	Type	Direction	Function
Video interface · OSD interface				
102	C7 (N.C.)	3-S (3-S)	O (O)	Video8 register = 0 Color difference signal output terminal of 7th bit. Video8 register = 1 The terminal becomes invalid.
104	C6 (N.C.)	3-S (3-S)	O (O)	Video8 register = 0 Color difference signal output terminal of 6th bit. Video8 register = 1 The terminal becomes invalid.
105	C5 (N.C.)	3-S (3-S)	O (O)	Video8 register = 0 Color difference signal output terminal of 5th bit. Video8 register = 1 The terminal becomes invalid.
106	C4 (OSDPLT)	3-S (3-S)	O (I)	Video8 register = 0 Color difference signal output terminal of 4th bit. Video8 register = 1 Input terminal to select pallet table of OSD. For OSDPLT=low, pallet table 0 is used. For OSDPLT=high, pallet table 1 is used.
107	C3 (OSDPEL3)	3-S (3-S)	O (I)	Video8 register = 0 Color difference signal output terminal of 3th bit. Video8 register = 1 It works as the OSD pallet data input terminal of 3rd bit.
109	C2 (OSDPEL2)	3-S (3-S)	O (I)	Video8 register = 0 Color difference signal output terminal of 2th bit. Video8 register = 1 It works as the OSD pallet data input terminal of 2rd bit.
110	C1 (OSDPEL1)	3-S (3-S)	O (I)	Video8 register = 0 Color difference signal output terminal of 1th bit. Video8 register = 1 It works as the OSD pallet data input terminal of 1rd bit.
111	C0 (OSDPEL0)	3-S (3-S)	O (I)	Video8 register = 0 Color difference signal output terminal of 0th bit. Video8 register = 1 It works as the OSD pallet data input terminal of 0rd bit.

Video interface terminal list

Pin No.	Pin name	Type	Direction	Function
Video interface				
84	VCLK	3-S	I/O	Clock gained by dividing VCLK x 2 signal into halves.
85	VMASTER	I	I	Input terminal to switch video master/slave. VMASTER=L Video master mode. Video synchronizing signal and video clock are internally generated. HTYPE=H Video slave mode. Video synchronizing signal and video clock are re ceived from the external.
87	VDEN#	I	I	Video output enable input terminal VDEN#=H Y [7:0] and C [7:0] terminals are made to be disable (3-state). VDEN#=L Y [7:0] and C [7:0] terminals are made to be enable. Note: C [7:0] terminal is the multiplexed terminal as OSDPLT [3:0] and so on. For Video8 register = 0, VDEN# terminal is valid for Y [7:0] alone.
88	CBLANK	O	O	Composite blank output terminal. Horizontal/vertical blanking area and polarity are programmable.
89	VSYNC	3-S	I/O	Input/output terminal of vertically synchronous signal. Polarity and synchronous signal length are programmable.
90	HSYNC	3-S	I/O	Input/output terminal of horizontally synchronous signal.Polarity and synchronous signal length are programmable.
91	FI	3-S	I/O	Input/output terminal for identification of even/odd number field. Polarity is programmable.
92 94-97 99-101	Y[7:0]	3-S	O	Video8 register = 0 Brightness signal output/input terminal. Video8 register = 1 Brightness/color difference multiplex terminal as ITU-T656
124	VCLK X 2	3-S	I/O	Terminal to input video clock or output 27 MHz.

Audio interface terminal list

Pin No.	Pin name	Type	Direction	Function
Audio interface				
112	AIN	I	I	Audio (PCM) input terminal. Stereo x1
114-116	AOUT[2:0]	O	O	Audio (PCM) output terminal. Stereo x3
117	S/PDIF (AOUT[3])	O	O	S/PDIF output terminal AC-3 stream or PCM stream can be output. Moreover, it works as the audio output terminal of 7th and 8th channels
118	ALRCLK	O	O	Left/Right clock output terminal of AOUT [2:0] and AIN. The polarity is programmable.
119	ABCLK	O	O	Bit clock output terminal of AOUT [2:0] and AIN. The polarity is programmable.
132	AMCLK	3-S	I/O	Audio master clock input/output terminal. 256 Fs or 386 Fs can be used.

DVD-DSP interface terminal list

Pin No.	Pin name	Type	Direction	Function
DVD-DSP interface				
143	DVDERR	I	I	Data error input for DVD-DSP connection.
144	DVDSOS	I	I	Sector start input for DVD-DSP connection.
146	DVDVALID	I	I	Data valid input for DVD-DSP connection.
147	DVDSTRB	I	I	Data strobe input for DVD-DSP connection.
148	DVDREQ	O	O	Data request output for DVD-DSP connection.
149 151-154 156-158	DVDDAT[7:0]	I	I	Stream input for DVD-DSP connection

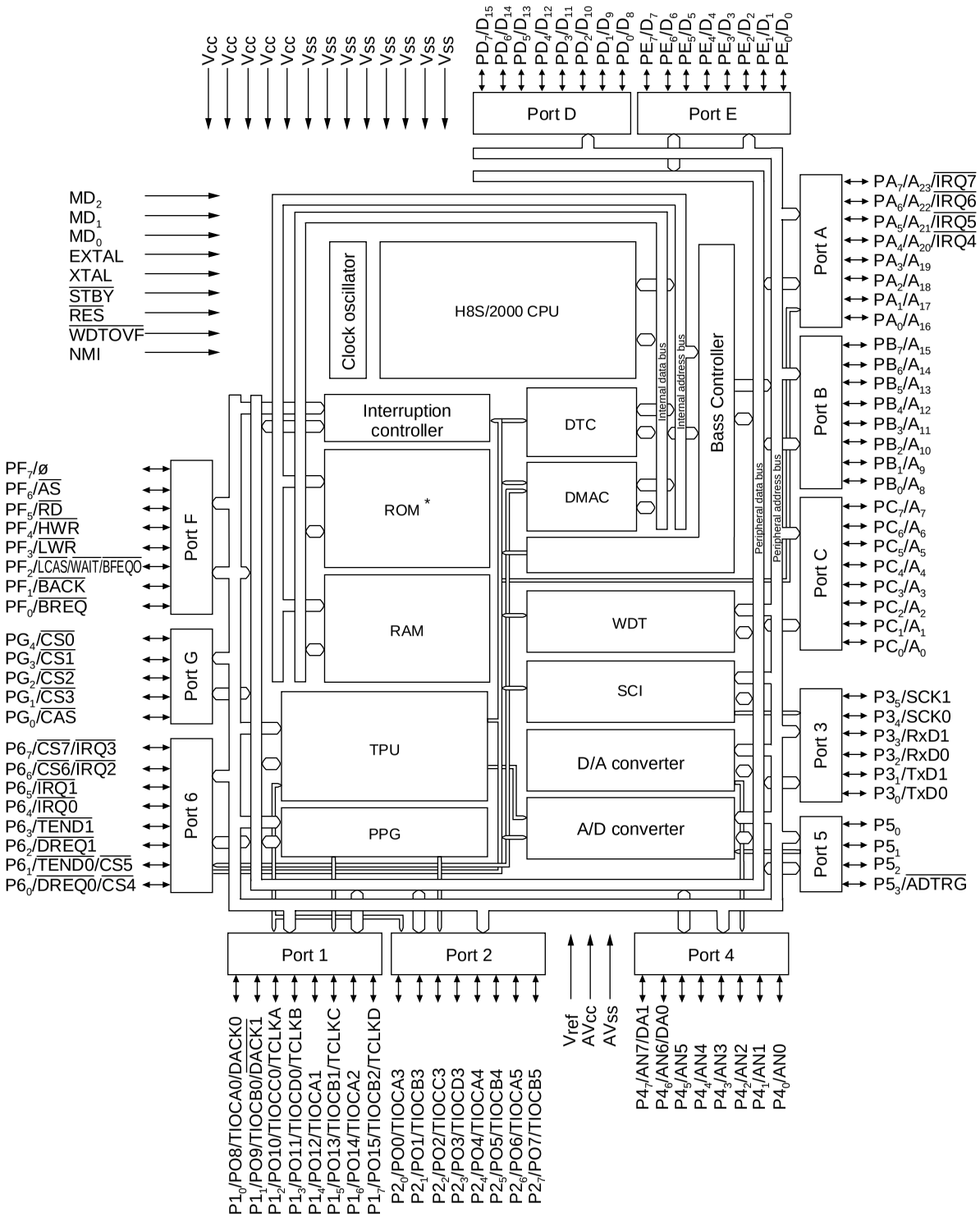
SD-RAM interface terminal list

Pin No.	Pin name	Type	Direction	Function
SDRAM interface				
38-39 42-47 49-52	RAMADD[11:0]	O	O	Address bus output for SDRAM connection.
54	RAMCS0#	O	O	Tip select output for SDRAM connection.
55	RAMCS1#	O	O	Tip select output terminal for SDRAM connection. It is connected to 2nd SDRAM.
56	RAMRAS#	O	O	RAS output terminal for SDRAM connection.
57	PCLK	O	O	Clock output terminal for SDRAM connection.
59	RAMCAS#	O	O	CAS output terminal for SDRAM connection.
60	RAMWE#	O	O	Write enable output terminal for SDRAM.
61	RAMDQM	O	O	Data masking output terminal for SDRAM.
62 64-67 69-72 74-79 82	RAMDAT[15:0]	3-S	I/O	Bi-directional data bus for SDRAM.

Power terminal · other list

Pin No.	Pin name	Type	Direction	Function
Power terminal · other				
1, 13, 23 40, 41 53, 68 80, 81 93, 108 120, 121 125, 131 145, 160	GND			Ground terminal
8, 18, 28 33, 48 58, 63 73, 86 98, 103 113, 133 140, 150, 155	VDD			+ 3.3V power input terminal
83	TESTMODE	I	I	Test terminal. Pull it down to GND.
127	SCNENBL	I	I	Test terminal. Pull it up to VDD.
130	PWRDN#	I	I	Power-down terminal. When it is [low], current consumption becomes minimum with all functions of the device stopped. (Power-down mode) To return it to normal state, set the terminal at [high]. Then, reset the device with RESET# terminal.
134	PLLGND			Ground terminal for internal PLL.
138	PLLVDD			Internal PLL + 3.3V power input terminal.
139	ICEMODE	I	I	Test terminal. Pull it down to GND.

12-9. IC504 IX1478GE
SYSCON



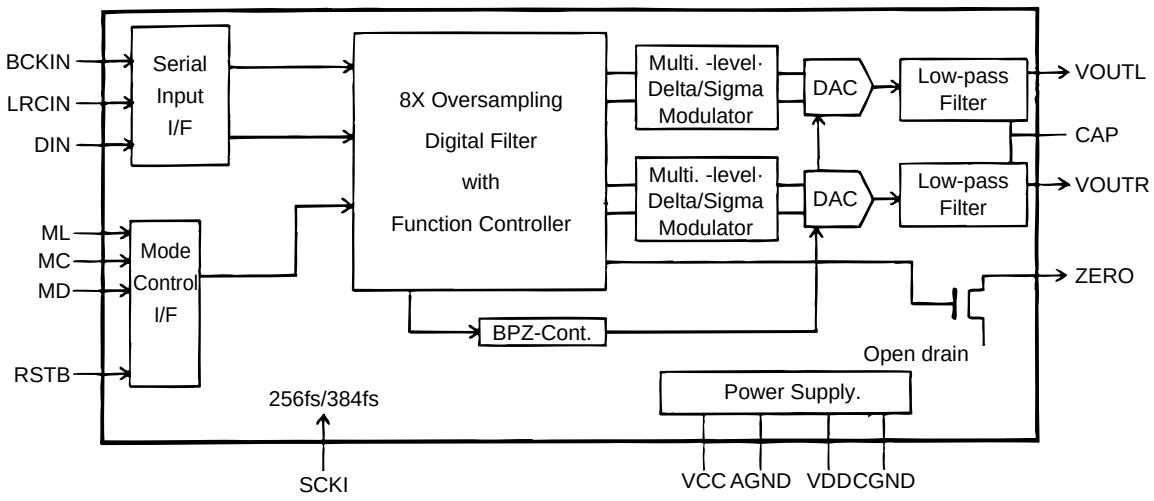
12-10. IC801~803 AUDIO D/A CONVERTER

12-10-1. Explanation of terminals

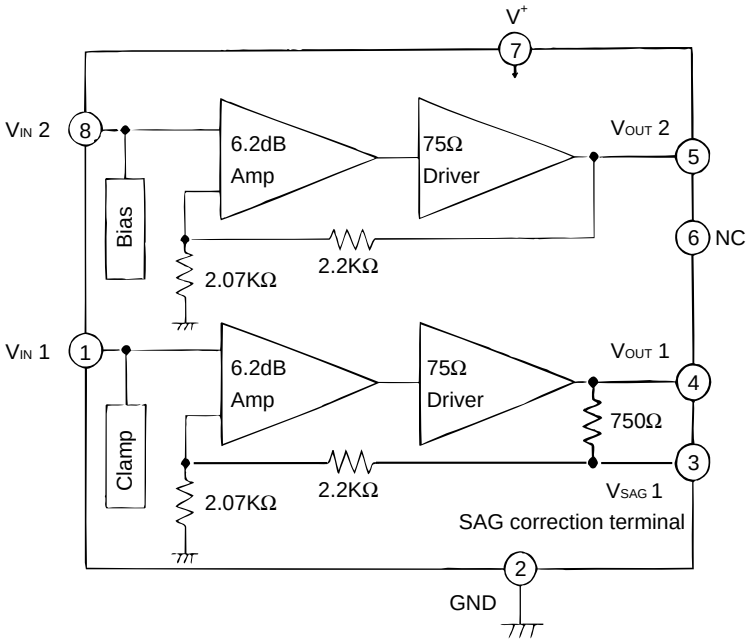
Pin No.	Terminal name	I/O	Operation function
1	NC	–	Not connected.
2	SCKI	I	System clock input. (256fs/384fs)
3	TEST	–	Not connected. Be sure to open.
4	ML	I	Control data input. Enable terminal. *1
5	MC	I	Control data input. Bit clock terminal. *1
6	MD	I	Control data input. Data terminal. *1
7	RSTB	I	Reset input terminal. Active “L” *1
8	ZERO	O	Infinity zero flag output terminal. Open drain.
9	VOUTR	O	Rch analog voltage output terminal.
10	AGND	–	Analog GND terminal.
11	VCC	–	Analog power terminal.
12	VOUTL	O	Lch analog voltage output terminal.
13	CAP	–	Internal bias decouple terminal
14	BCKIN	I	Audio data. Bit clock input terminal. *2
15	DIN	I	Audio data. Data input terminal. *2
16	LRCIN	I	Audio data. Reference sampling clock input terminal. *2
17	TEST	–	Connect to GND.
18	NC	–	Not connected. Be sure to open.
19	VDD	–	Digital power terminal.
20	DGND	–	Digital GND terminal.

*1: Internal pull-up provided. Schmidt trigger input.
*2: Schmidt trigger input.

12-10-2. Block Diagram



12-11. IC2002, IC2003 AMP



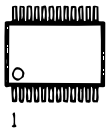
12-12. IC402 IX1474GE DEM/ECC (DVD)

Pin No.	Terminal name	I/O	Operation function	Remarks
1	DPCK1	I	Signal processing reference clock input.	0.5-3.3Vp-p Feedback resistor built in.
2	DVDD3	–	Digital power. (3.3V)	For logic cell
3	SVCK1	I	Servo reference clock input. (Oscillation circuit input terminal)	3.3V-I/F Feedback resistor built in.
4	SVCK0	O	Servo reference clock output. (Oscillation circuit input terminal)	
5	DVSS	–	Digital power. (0V)	For logic cell
6	DVDD2	–	Digital power. (3.3V)	For logic cell
7	N.C.	–	User use prohibited.	Open
8	HDWT	I	MPU write signal.	TTL level
9	HDRD	I	MPU read signal.	TTL level
10	HCEN	I	MPU chip selection.	TTL level
11	HD0	I/O	MPU data bus.	TTL level
12	HD1	I/O	MPU data bus.	TTL level
13	HD2	I/O	MPU data bus.	TTL level
14	HD3	I/O	MPU data bus.	TTL level
15	HD4	I/O	MPU data bus.	TTL level
16	HD5	I/O	MPU data bus.	TTL level
17	HD6	I/O	MPU data bus.	TTL level
18	HD7	I/O	MPU data bus.	TTL level
19	DVSS	–	Digital power. (0V)	For I/O cell
20	DVDD5	–	Digital power. (5V)	For I/O cell
21	HINT	O	MPU interruption signal. (Occurrence of interruption = “L”)	OPEN DRAIN
22	HA0	I	MPU address bus.	TTL level
23	HA1	I	MPU address bus.	TTL level
24	PLCK	I/O	Read channel clock input/output terminal.	

Pin No.	Terminal name	I/O	Operation function	Remarks
25	ED0	–	User use is prohibited (N.C.) since it is for shipping adjustment.	Open
26	ED1	–		
27	ED2	–		
28	ED3	–		
29	ED4	–		
30	ED5	–		
31	ED6	–		
32	ED7	–		
33	TEST	I	For shipping adjustment.	Set to “L”
34	PDON	O	PLL phase error signal output. (Negative polarity)	
35	PDOP	O	PLL phase error signal output. (Positive polarity)	
36	RLLD	O	RLL detection result output.	
37	LPFN	I	PLL loop filter amp. reverse input.	
38	LPFO	O	PLL loop filter amp. output.	
39	VCOF	O	VCO filter terminal.	
40	SLCO	O	Built-in comparator reference voltage output terminal.	
41	AVSS	–	Analog power. (0V)	
42	AVR	O	Non-PLL system analog reference potential. (1.65V)	
43	VRC	–	Resistance division point potential. (For analog reference potential generation: 1.65)	
44	PVR	O	PLL system analog reference potential. (1.65V)	
45	AVDD	–	Analog power. (3.3V)	
46	RVR2	–	2nd reference voltage. (For capacitor connection)	
47	RVDD	–	Exclusive-use power terminal. (3.3V)	
48	RFIN	I	RF signal input.	
49	RVSS	–	Exclusive-use power terminal. (0V)	
50	RVR1	–	1nd reference voltage. (For capacitor connection)	
51	DVR	I	DMO reference potential. (1.65V recommended)	
52	DMO	O	Disc equalizer output for DVD. (Triple value PWM + HiZ)	
53	RASN	O	External RAM row address selection. (Negative logic)	
54	CASN	O	External RAM row address selection. (Negative logic)	
55	MOEN	O	External RAM output permission signal.	
56	MWEN	O	External RAM read/write selection.	
57	DVSS	–	Digital power. (0V)	For logic cell
58	DVDD3	–	Digital power. (3.3V)	For logic cell
59	MA9	O	External RAM address bus.	
60	MA8	O	External RAM address bus.	
61	MA7	O	External RAM address bus.	
62	MA6	O	External RAM address bus.	
63	MA5	O	External RAM address bus.	
64	MA4	O	External RAM address bus.	
65	MA3	O	External RAM address bus.	
66	MA2	O	External RAM address bus.	
67	MA1	O	External RAM address bus.	
68	MA0	O	External RAM address bus.	
69	DVSS	–	Digital power. (0V)	For I/O cell
70	DVDD5	–	Digital power. (5V)	For I/O cell
71	MD7	I/O	External RAM data bus.	TTL level

Pin No.	Terminal name	I/O	Operation function	Remarks
72	MD6	I/O	External RAM data bus.	TTL level
73	MD5	I/O	External RAM data bus.	TTL level
74	MD4	I/O	External RAM data bus.	TTL level
75	MD3	I/O	External RAM data bus.	TTL level
76	MD2	I/O	External RAM data bus.	TTL level
77	MD1	I/O	External RAM data bus.	TTL level
78	MD0	I/O	External RAM data bus.	TTL level
79	SD7	O	MPEG data output.	
80	SD6	O	MPEG data output.	
81	SD5	O	MPEG data output.	
82	SD4	O	MPEG data output.	
83	DVSS	–	Digital power. (0V)	For logic cell
84	DVDD3	–	Digital power. (3.3V)	For logic cell
85	SD3	O	MPEG data output.	
86	SD2	O	MPEG data output.	
87	SD1	O	MPEG data output.	
88	SD0	O	MPEG data output.	
89	SERR	O	MPEG data reliability flag. (Data error: “L”)	
90	SBGN	O	MPEG output sector sync signal. (Sector top: “L”)	
91	SENB	O	MPEG data effective flag. (Effective state: “L”)	
92	SDCK	O	MPEG data transfer clock.	
93	DVSS	–	Digital power. (0V)	For logic cell
94	SREQ	I	MPEG data request flag. (Request state: “L”)	TTL level
95	RSTN	I	Hard reset input. (Reset state: “L”)	
96	DVDD3	–	Digital power. (3.3V)	For logic cell
97	STDA	O	Operation state monitor data. (Output synchronizing with SDCK fall)	Common with PWM.
98	STCK	O	Operation state monitor sync signal. (Data top bit: “L”)	Common with PWM.
99	UPWM	O	General-use PWM output.	4mA, 5V-I/F
100	DVSS	–	Digital power. (0V)	For logic cell

13. SEMICONDUCTOR LEAD IDENTIFICATION



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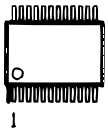

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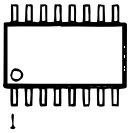

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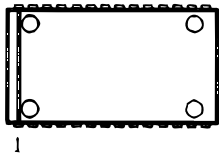

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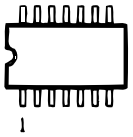

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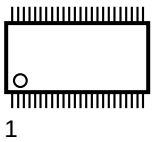

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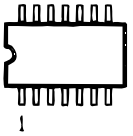

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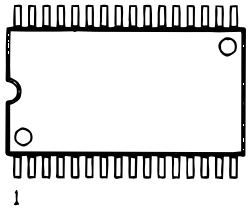

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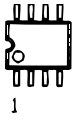

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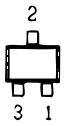

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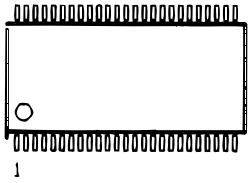

IC602
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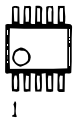
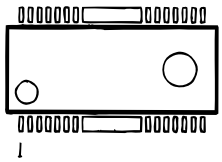
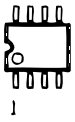


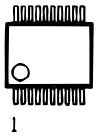
IC701
VHiLB1638M/-1



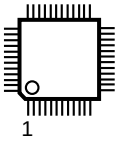
IC702
VHiBA6796FP-1



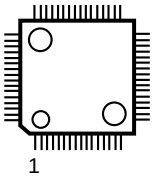
IC703 IC708
VHiBA10358F-1



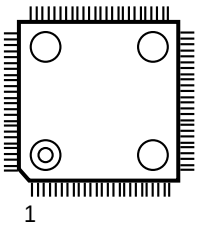
IC801 IC802 IC803
VHiPCM1720E-1



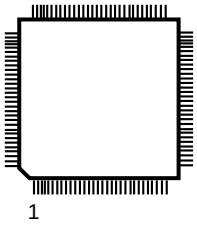
IC201
VHiMC44722V-1



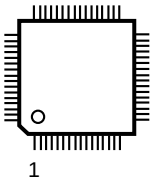
IC303
RH-iX1462GEZZ



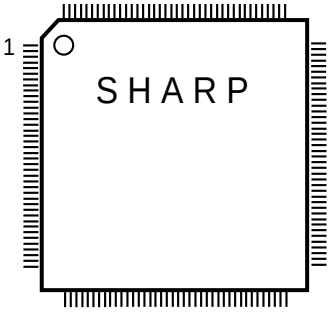
IC402
RH-iX1474GEZZ



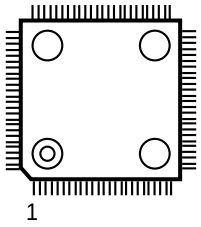
IC504
RH-iX1478GEZZ



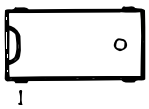
IC508
RH-iX1477GEZZ



IC601
RH-iX1475GEZZ



IC707
RH-iX1473GEZZ



X501
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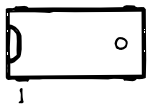

X601
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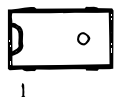

X702
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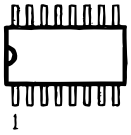

IC2001
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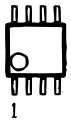
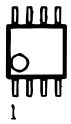


IC2002 IC2003
VHiNJM2268M-1

IC2102
VHiTC4W53F/-1



IC6001 IC6002
IC6003 IC6601
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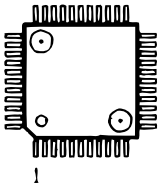

IC5001
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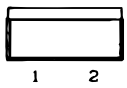

IC9001
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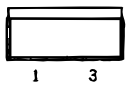
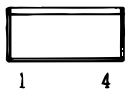


IC9002
VHiBA17808T-1



IC9003
VHiPQ15RW11-1